



1 / 50

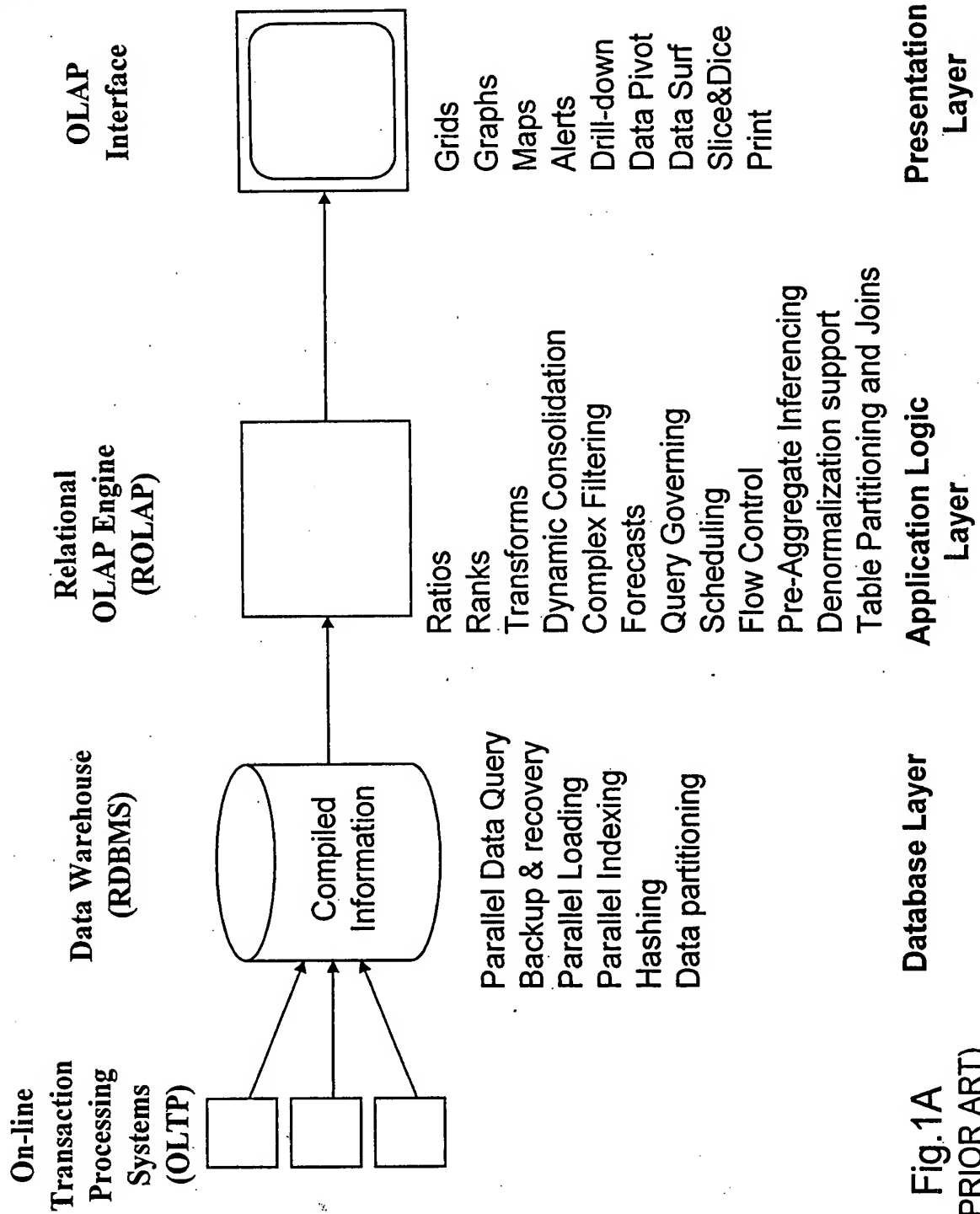


Fig.1A
(PRIOR ART)

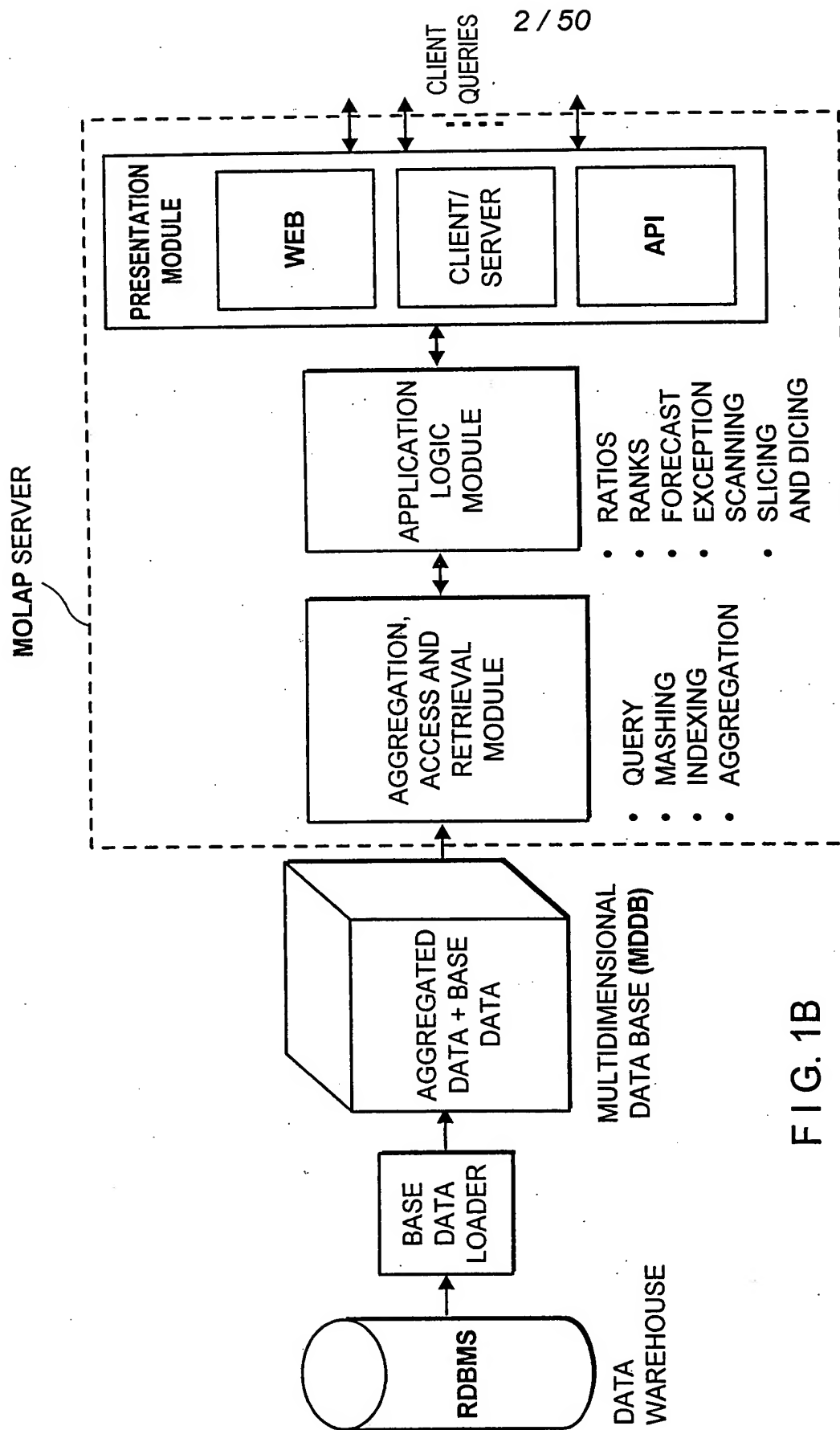


FIG. 1B

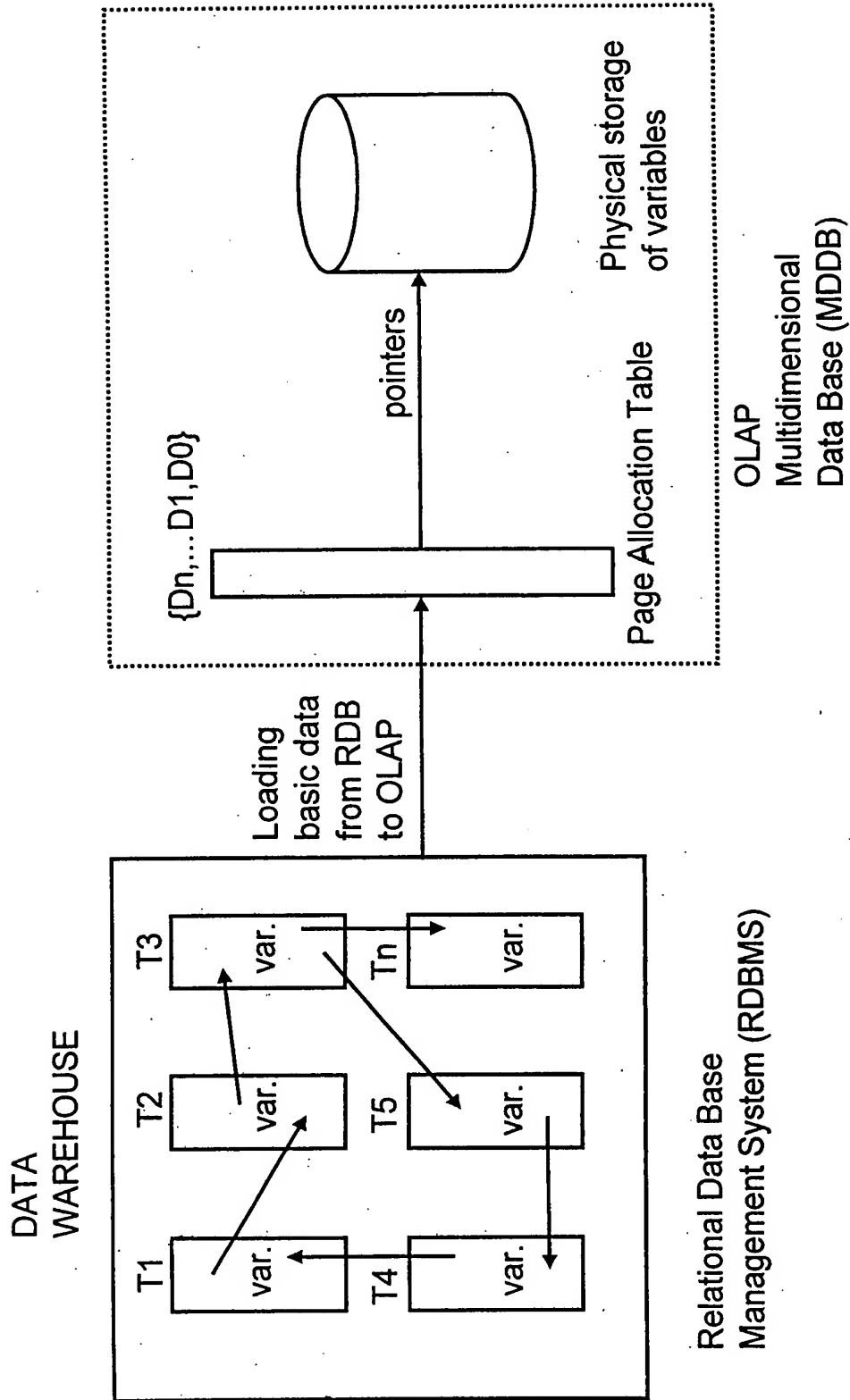
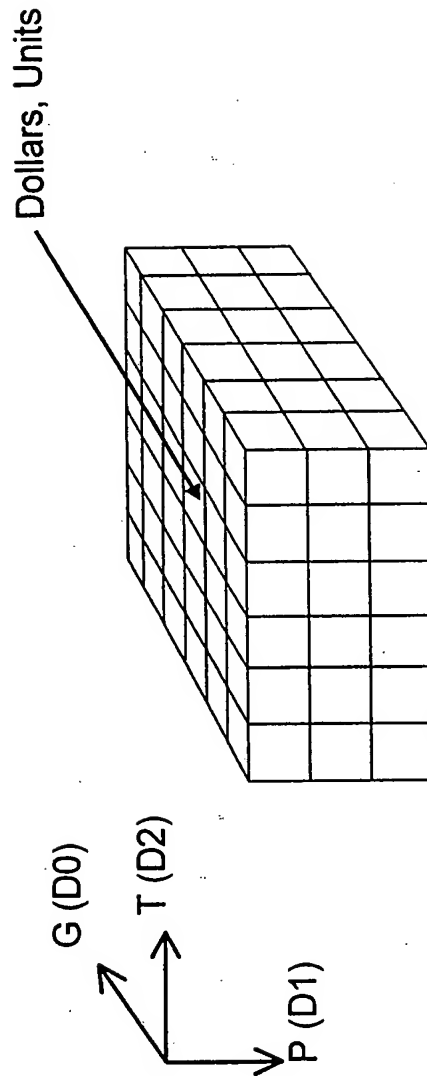


Fig. 2A
(PRIOR ART)



G geography (e.g. cities, states, countries, continents)
 T time (e.g., days, weeks, months, years)
 P products (e.g. all products, by manufacturer)

Fig. 2B
 (PRIOR ART)

**Array structure of a
multidimensional variable**

		D0					
		0	1	2	3	4	5
D2=0	D1= 0						
	D1= 1						
	D1= 2						
D2=1	D1= 0						
	D1= 1						
	D1= 2						
D2=2	D1= 0						
	D1= 1						
	D1= 2						
D2=3	D1= 0						
	D1= 1						
	D1= 2						
D2=3	D1= 0						
	D1= 1						
	D1= 2						

Fig. 2C
(PRIOR ART)

Page Allocation Table pointing on physical records of a multidimensional variable (e.g. the two first rows of a variable of FIG. 2B reside in page # 0)

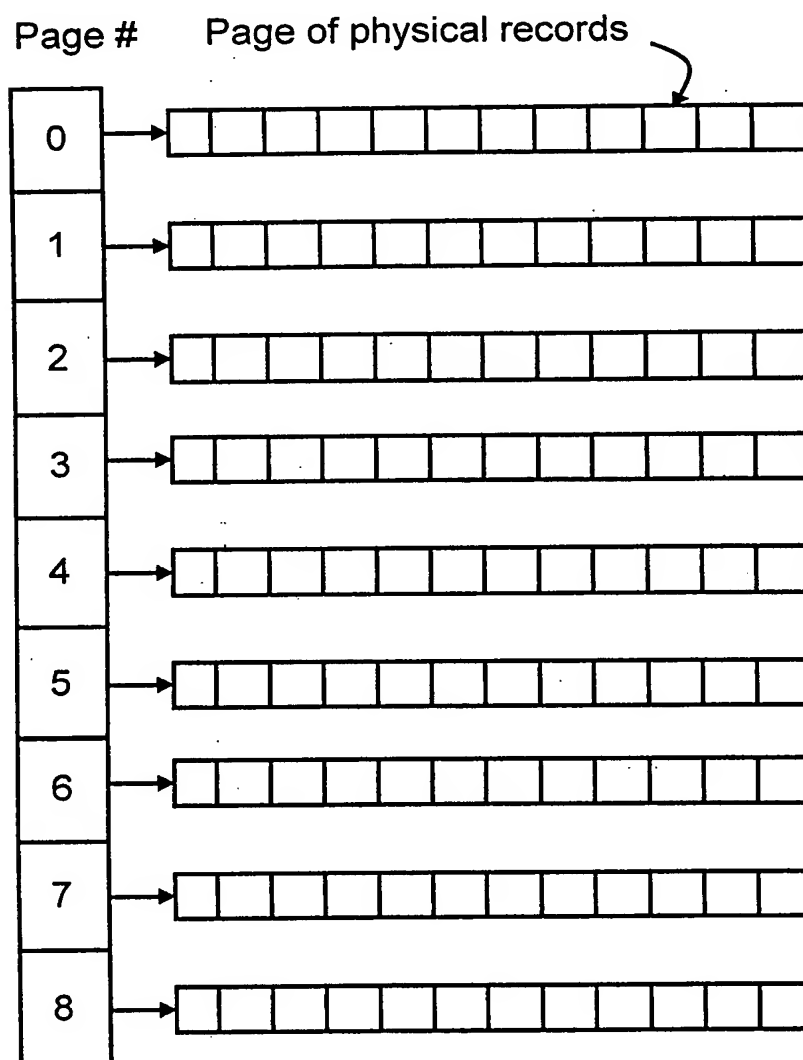


Fig. 2D
(PRIOR ART)

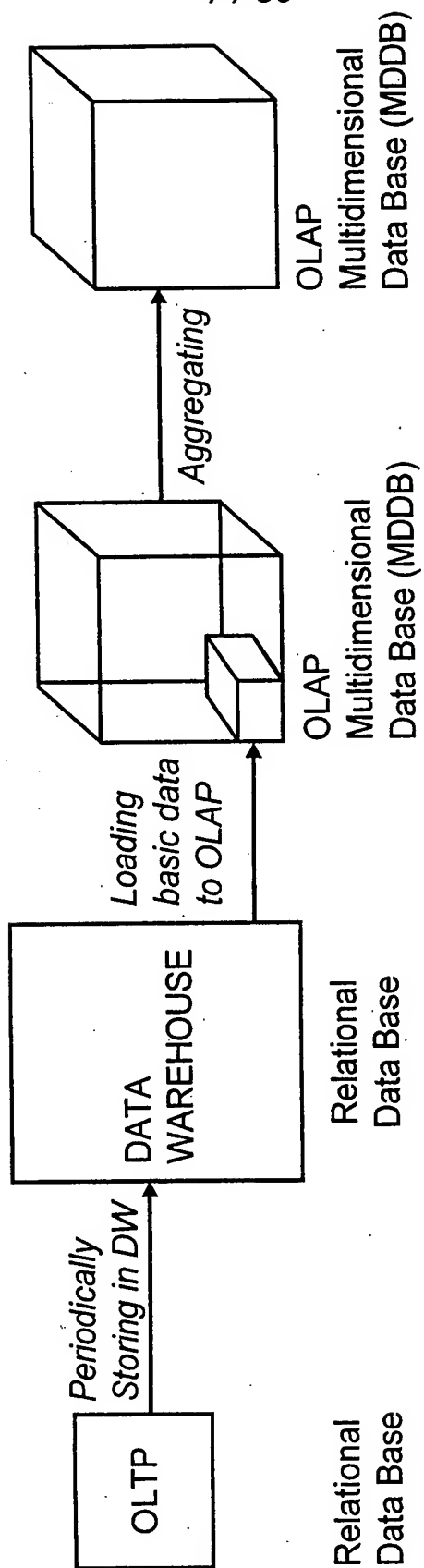


Fig. 3A
(PRIOR ART)

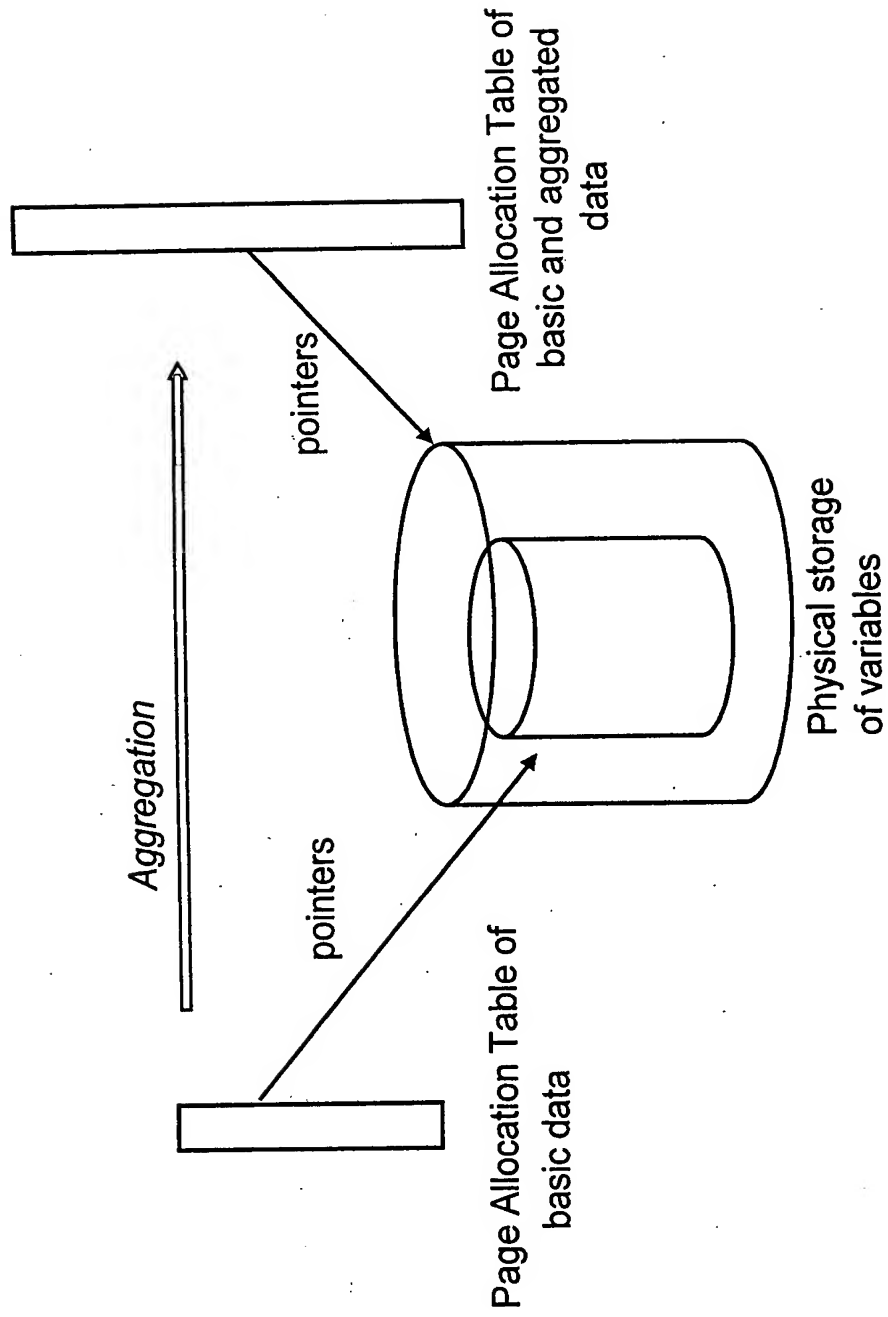


Fig. 3B
(PRIOR ART)

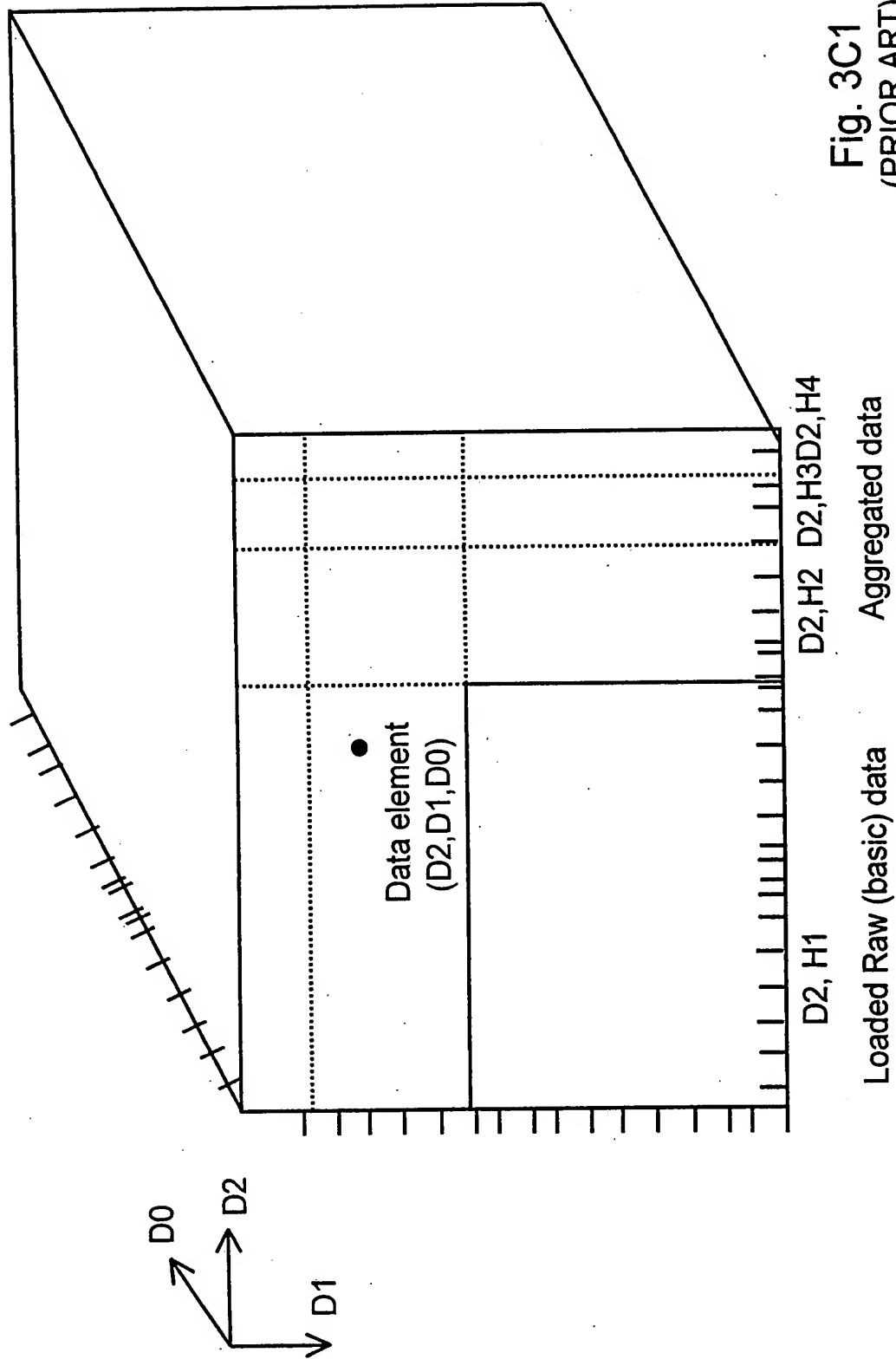
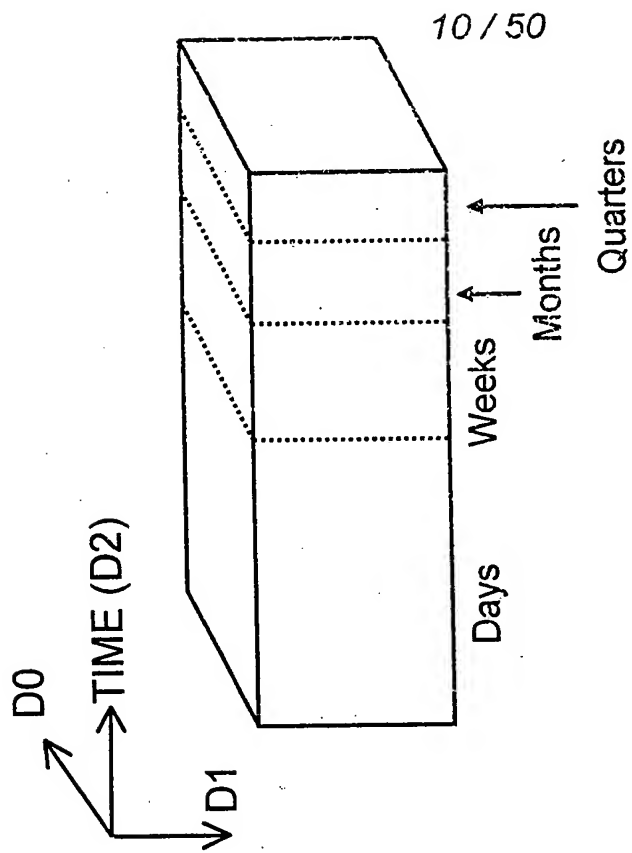
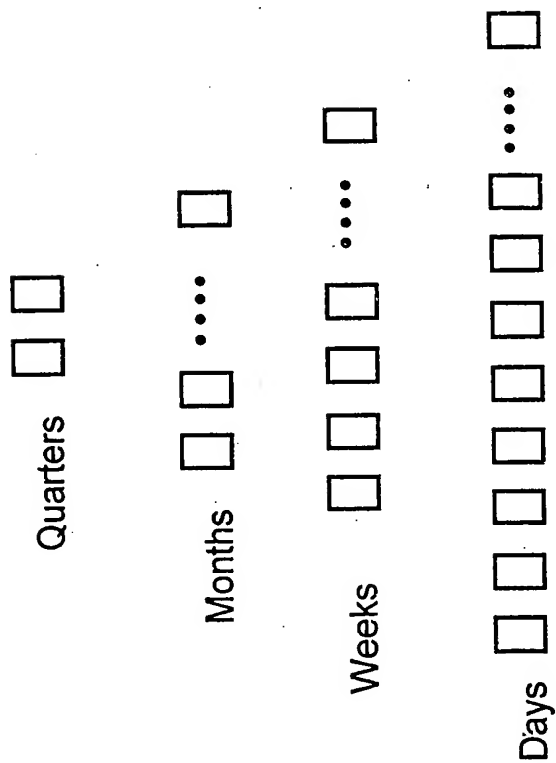


Fig. 3C1
(PRIOR ART)



Spatial occupancy of TIME hierarchy

Fig. 3C3
(PRIOR ART)



Hierarchy of TIME dimension

Fig. 3C2
(PRIOR ART)

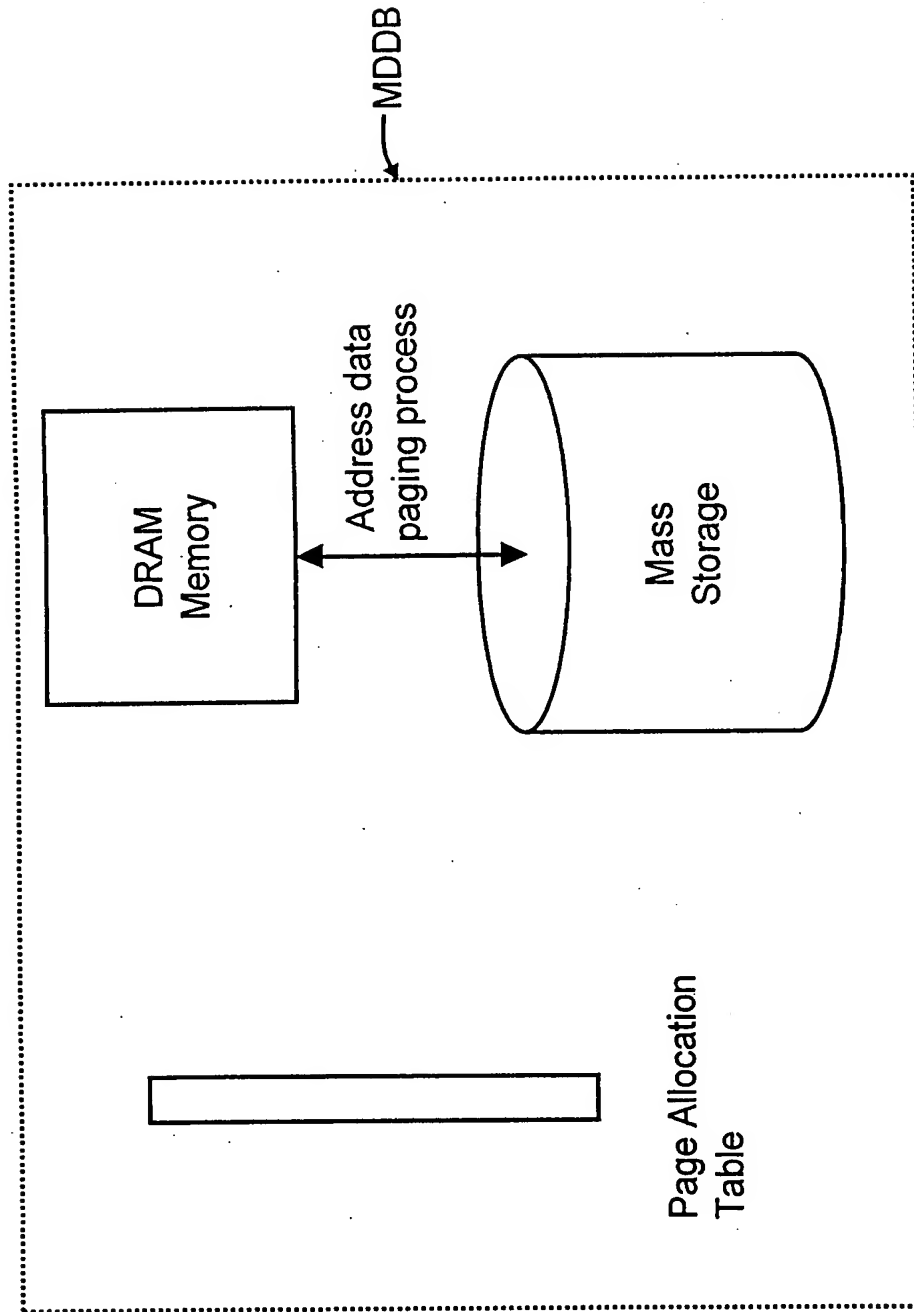


Fig. 4
(PRIOR ART)

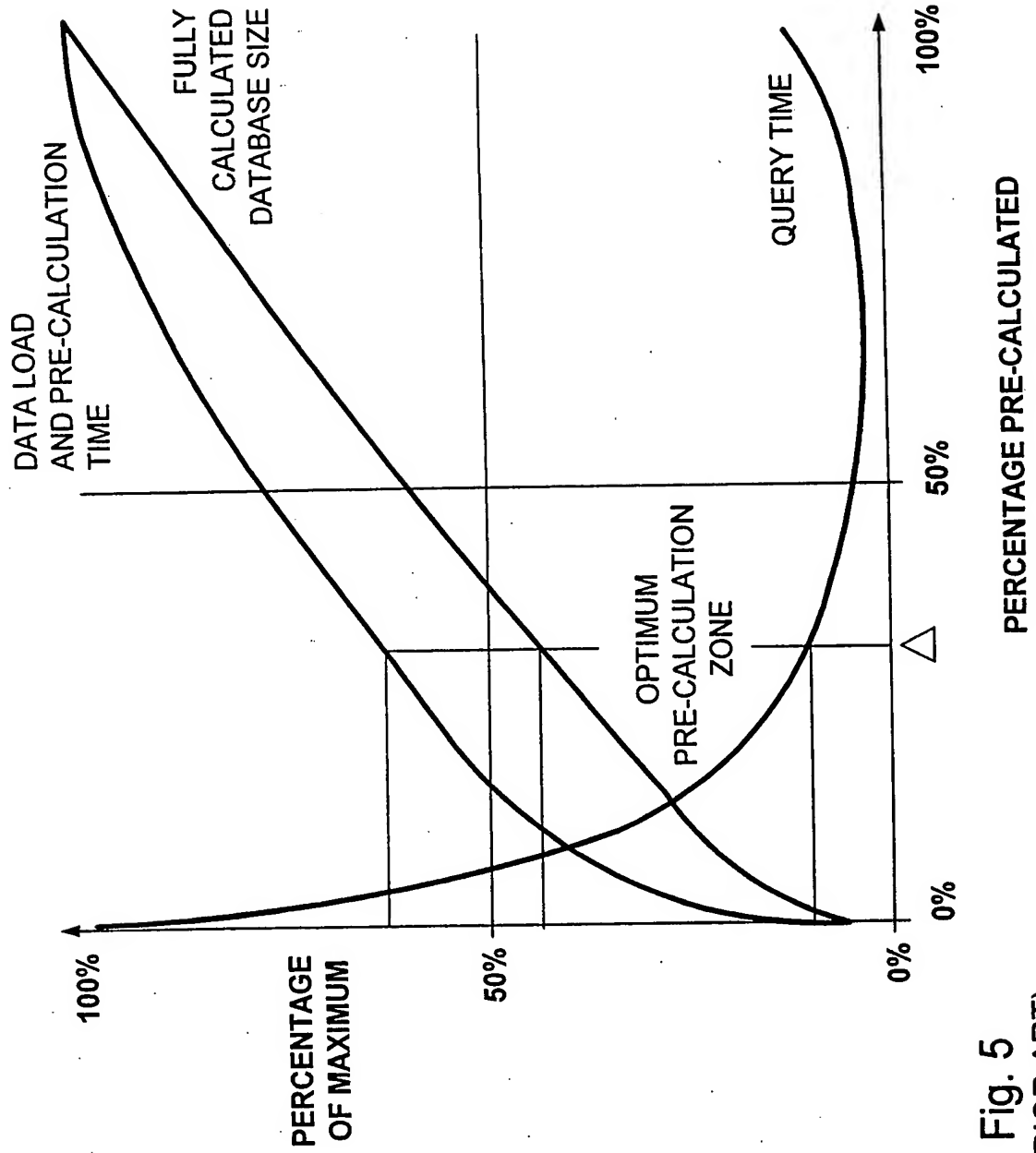


Fig. 5
(PRIOR ART)

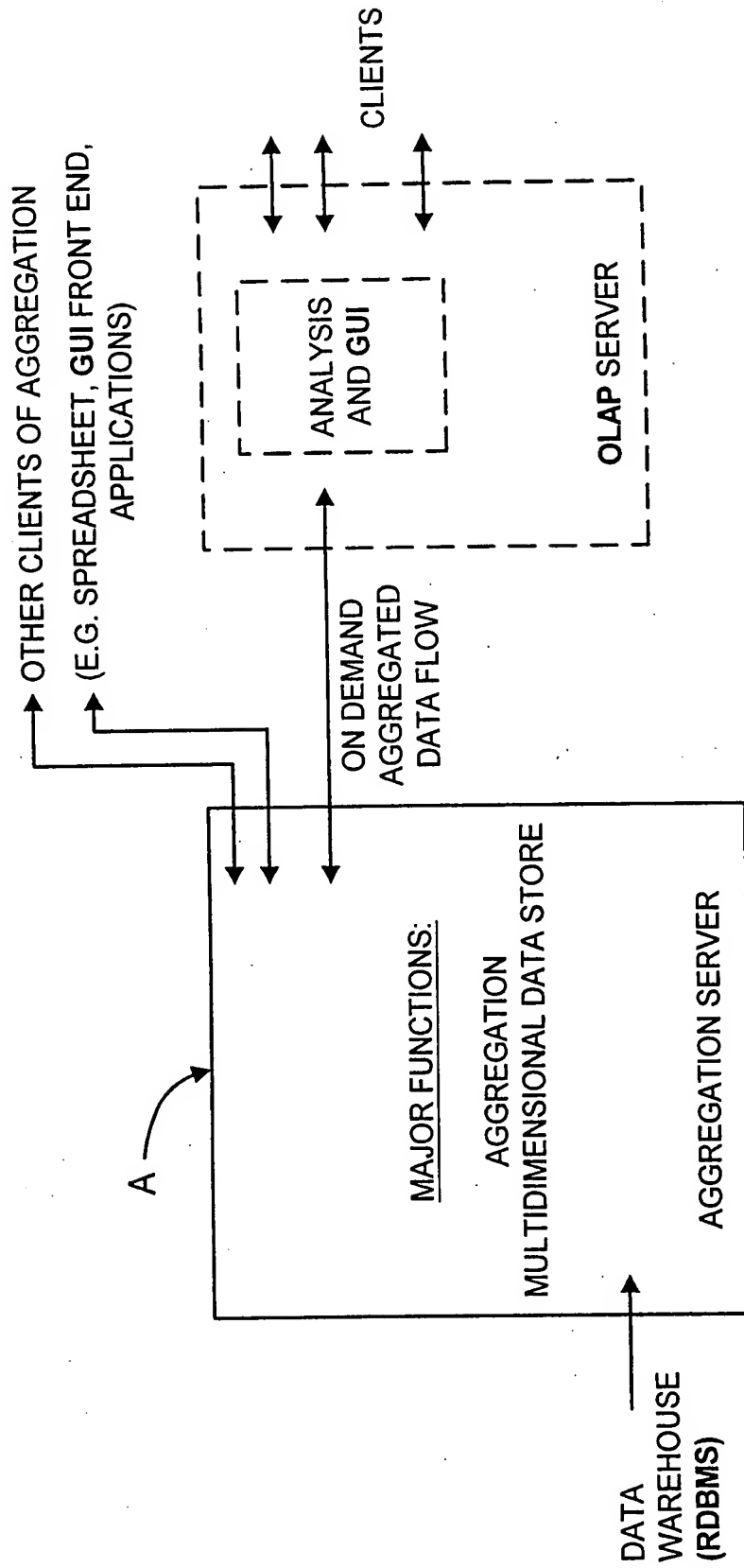


FIG. 6A

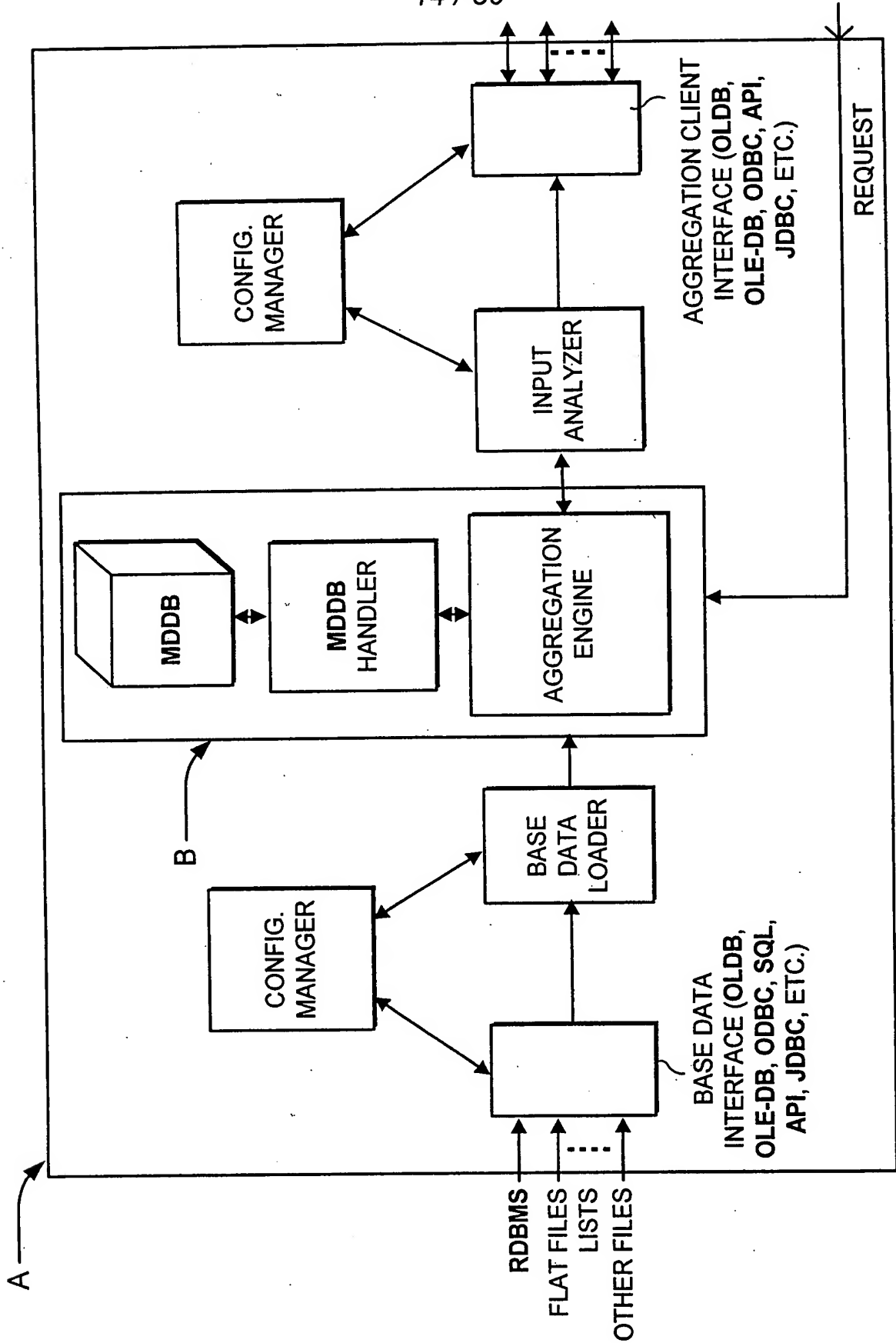


FIG. 6B

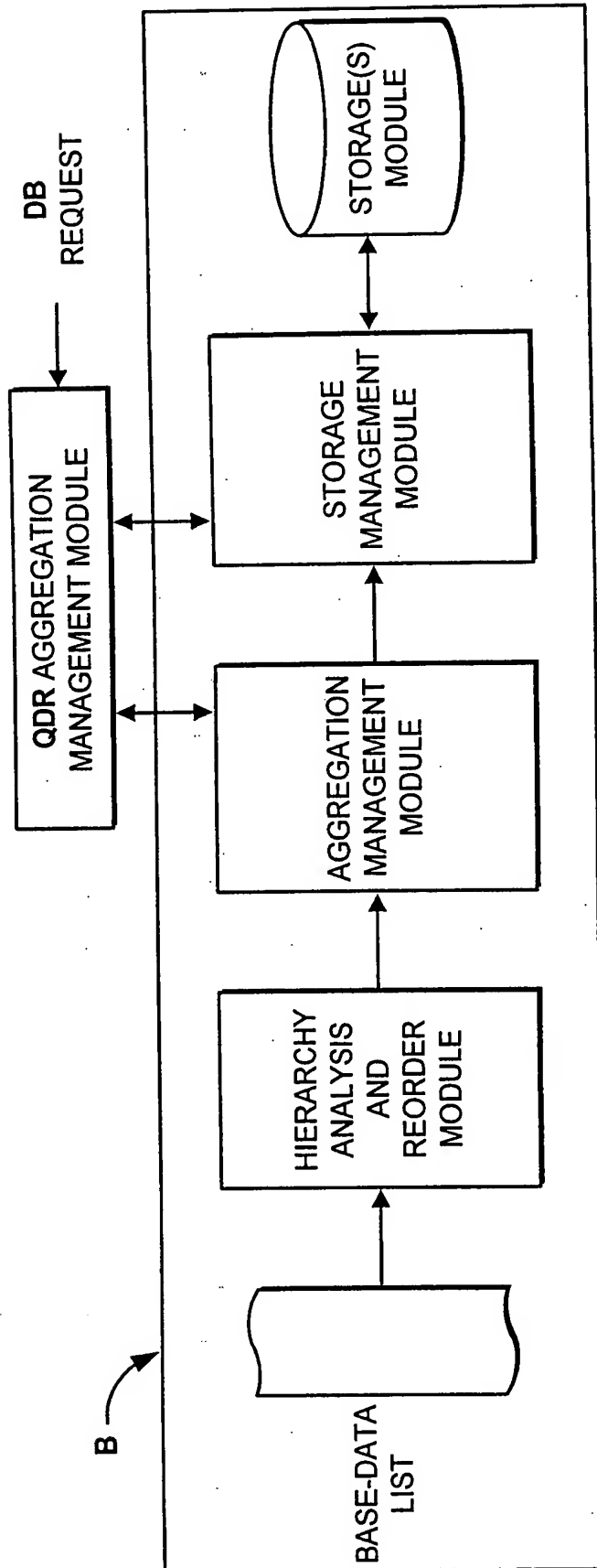


FIG. 6C

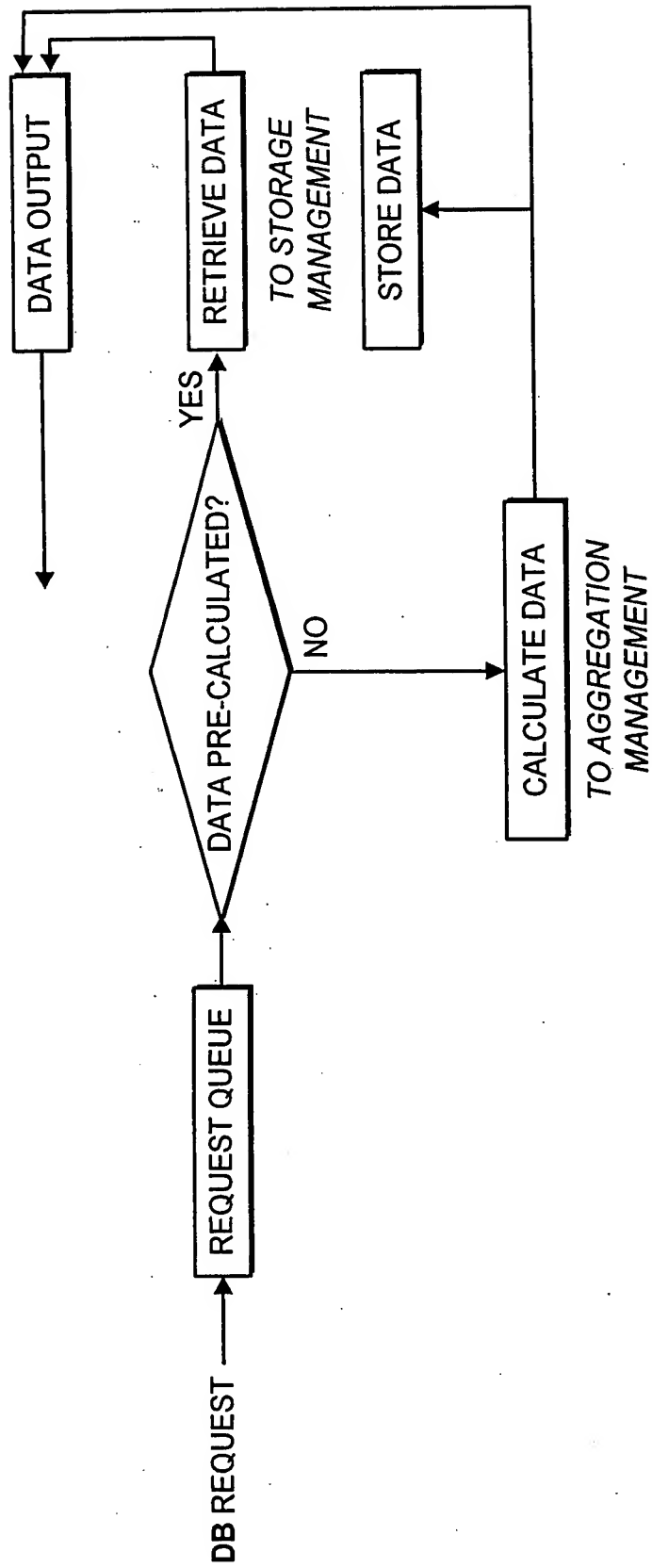


FIG. 6D

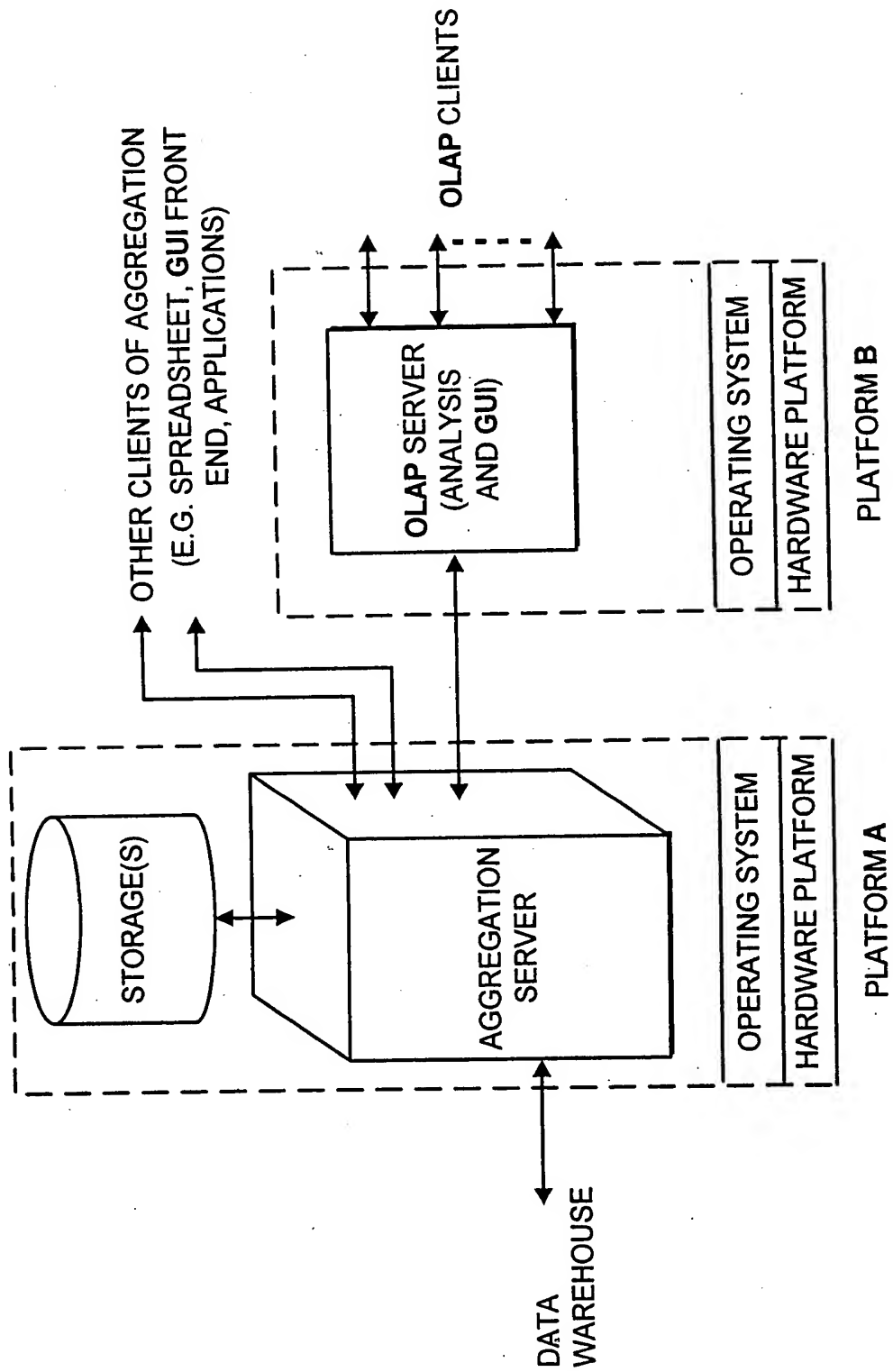


FIG. 7A

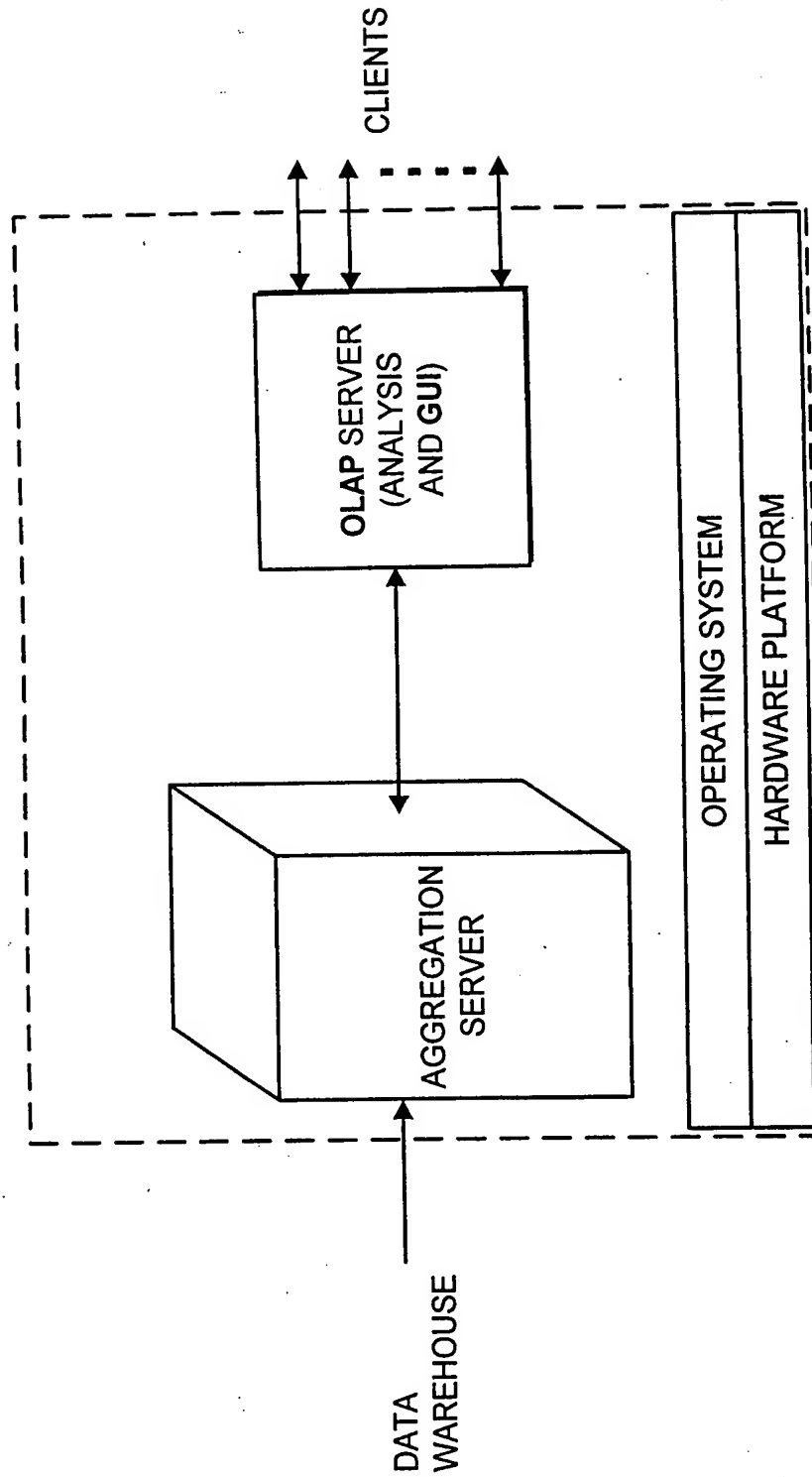


FIG. 7B

	NBR. OF DIM.	NBR. OF ATOMIC DATA DATA VALUES	LEAF NODE DENSITY %	NUMBER OF VALUES IN CUBE AFTER ROLL-UP	ORACLE EXPRESS V. 6.2	IMPLEMENTATION OF CURRENT INVENTION
D1	6	302M	9	427 M	16 h	15 m
D2	4	414M	1.27	969 M	50 m	5 m
D3	5	14,499M	0.03	63,954 M	31 h	1h 23 m
D4	6	623,494M	$8 * 10^{-4}$	7,930 G	EXCEEDS 48 h	2 h 20 m
D5	6	243,000M	10^{-8}	1,160,000 G	22 h	4 m
D6	4	7M	DEFINED AS 100	19 M	15 m	1 m

FIG. 8A

FIG. 9A

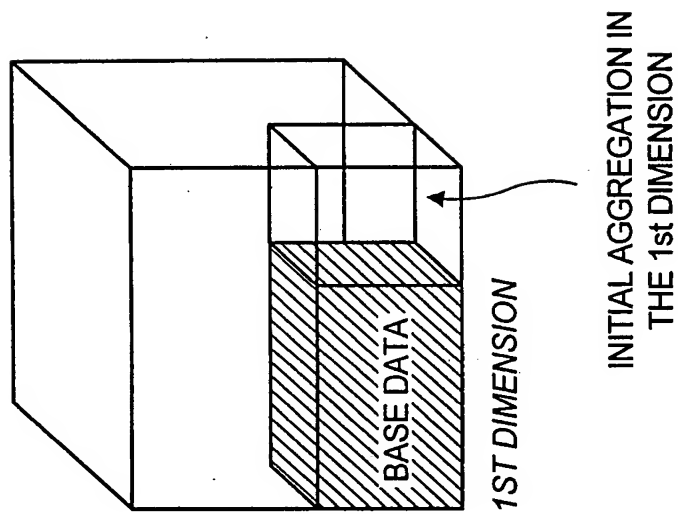
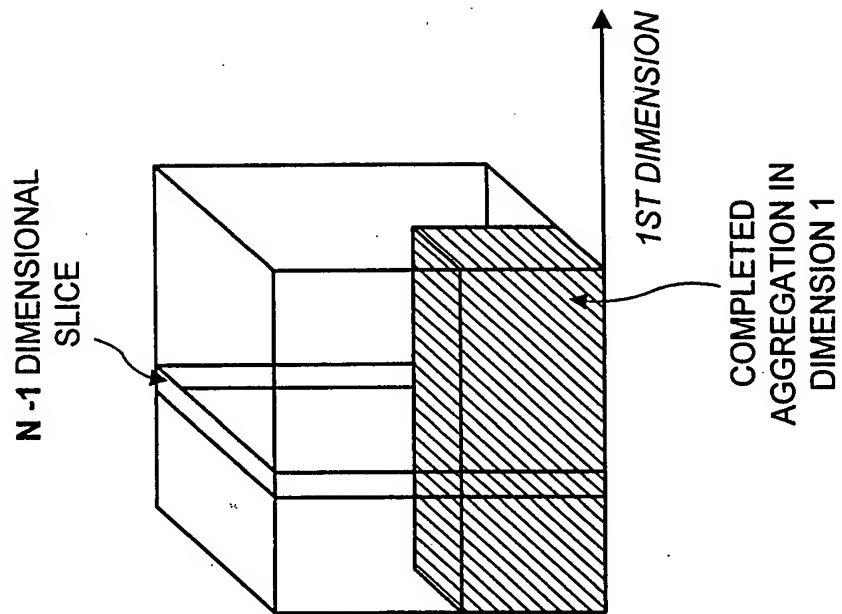
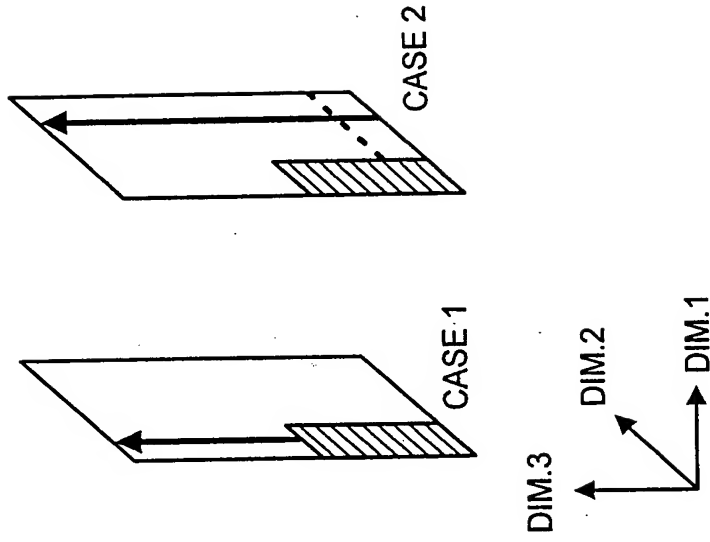


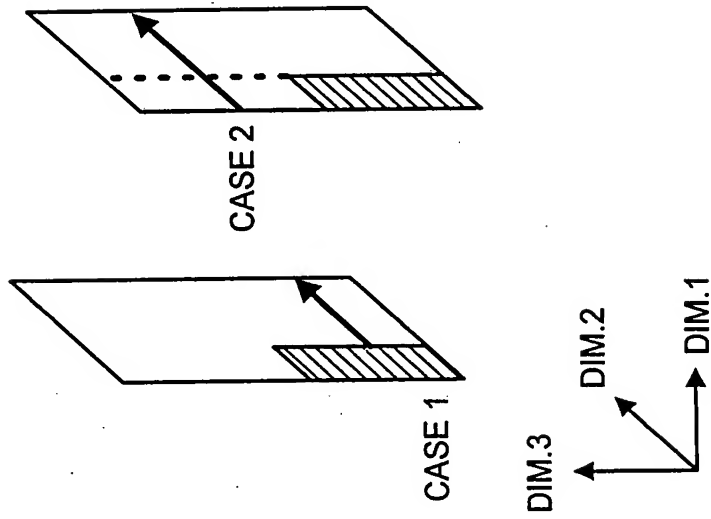
FIG. 9B





A. DIRECTED AGGREGATION IN
DIMENSION 3, CASES 1 AND 2

FIG. 9C2



A. DIRECTED AGGREGATION IN
DIMENSION 2, CASES 1 AND 2

FIG. 9C1

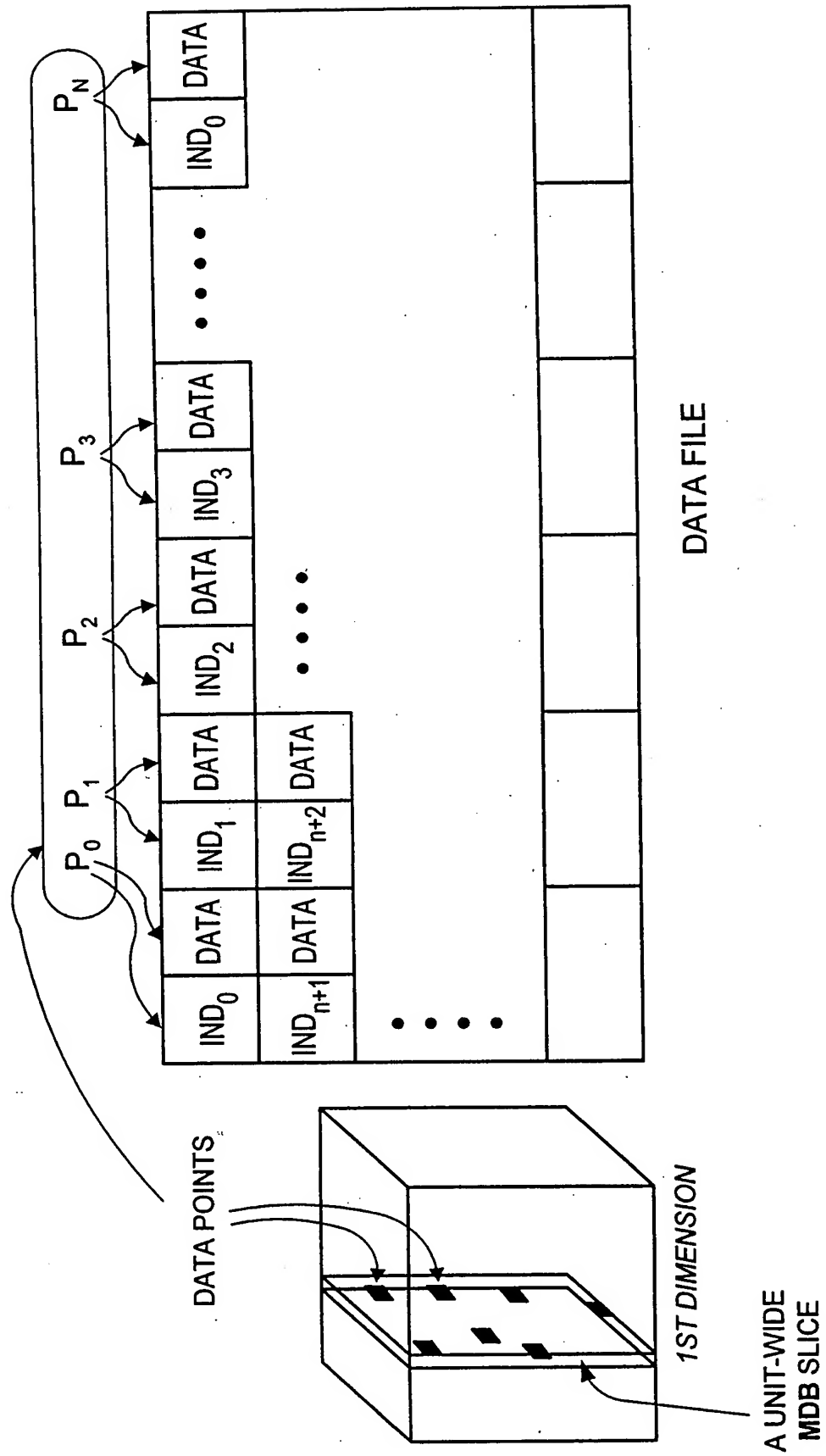


FIG. 10A

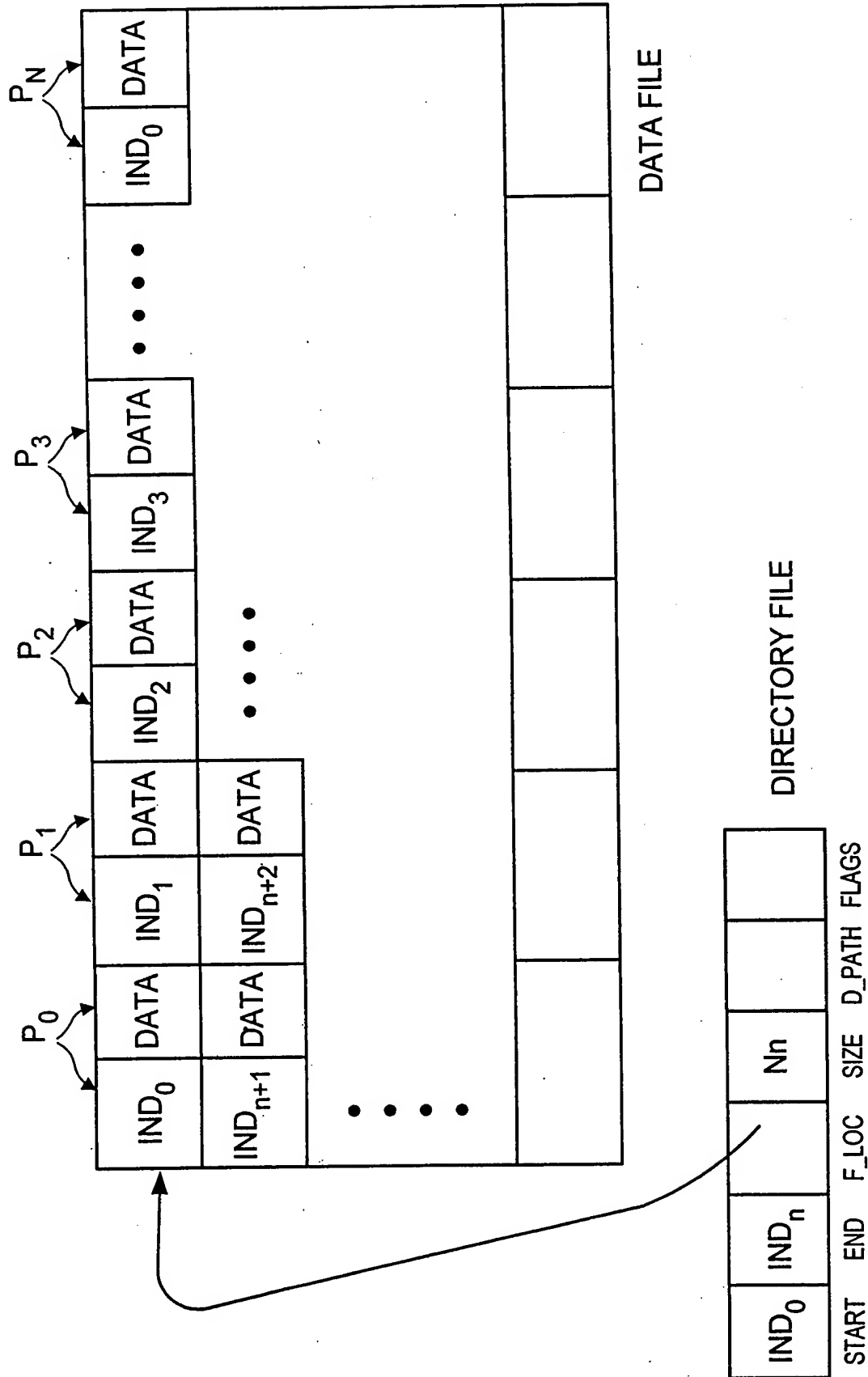


FIG. 10B

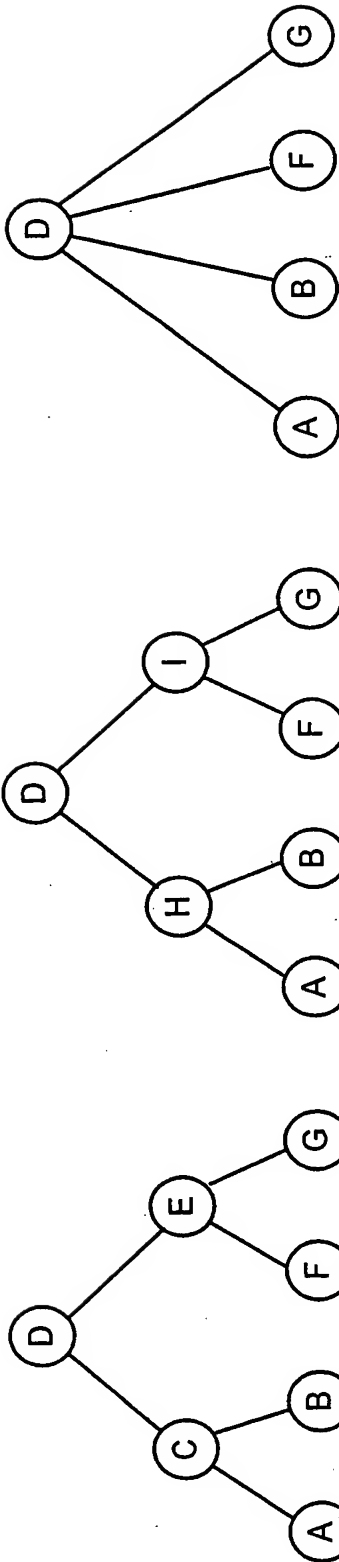
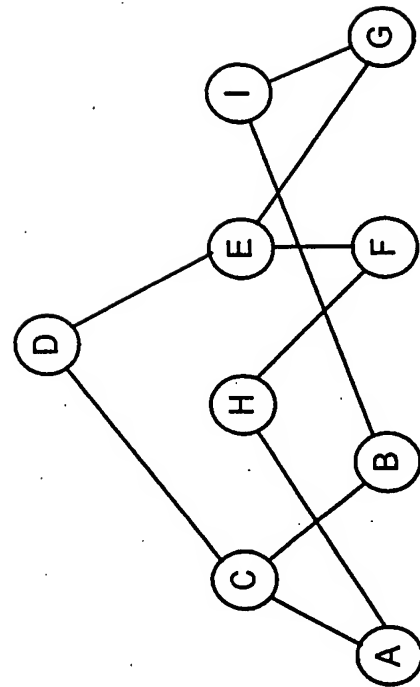


FIG. 11A



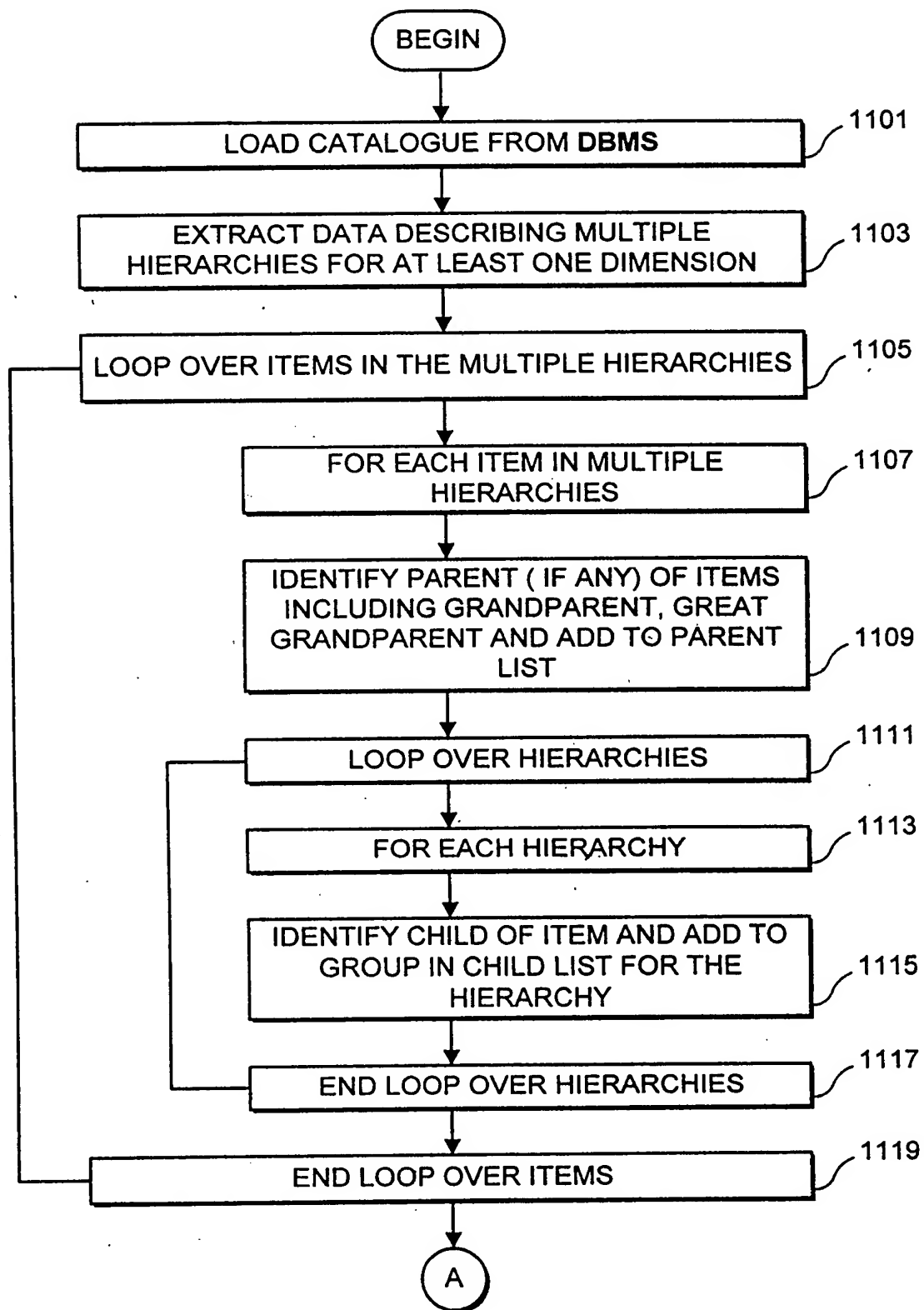


FIG. 11C(i)

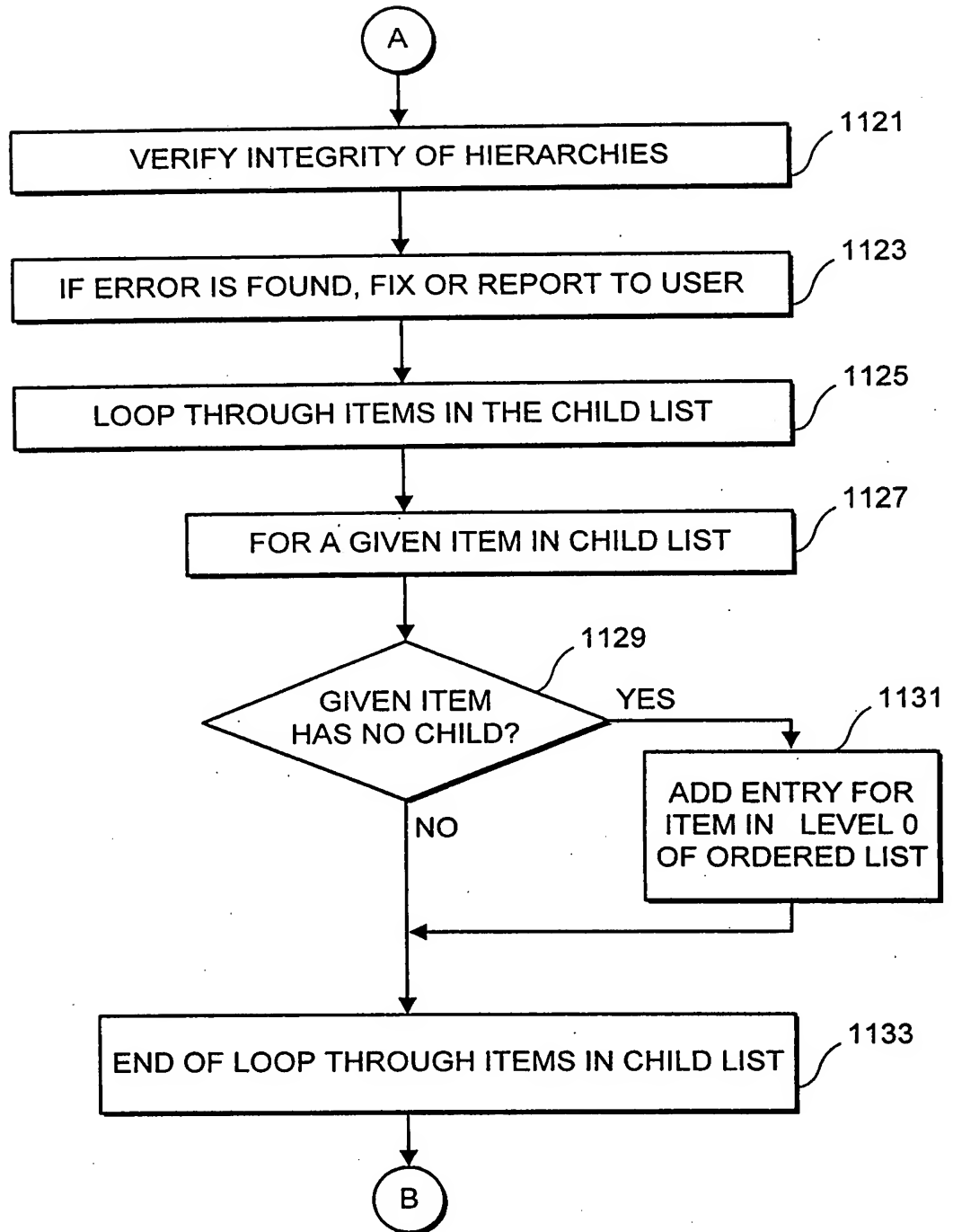


FIG. 11C(ii)

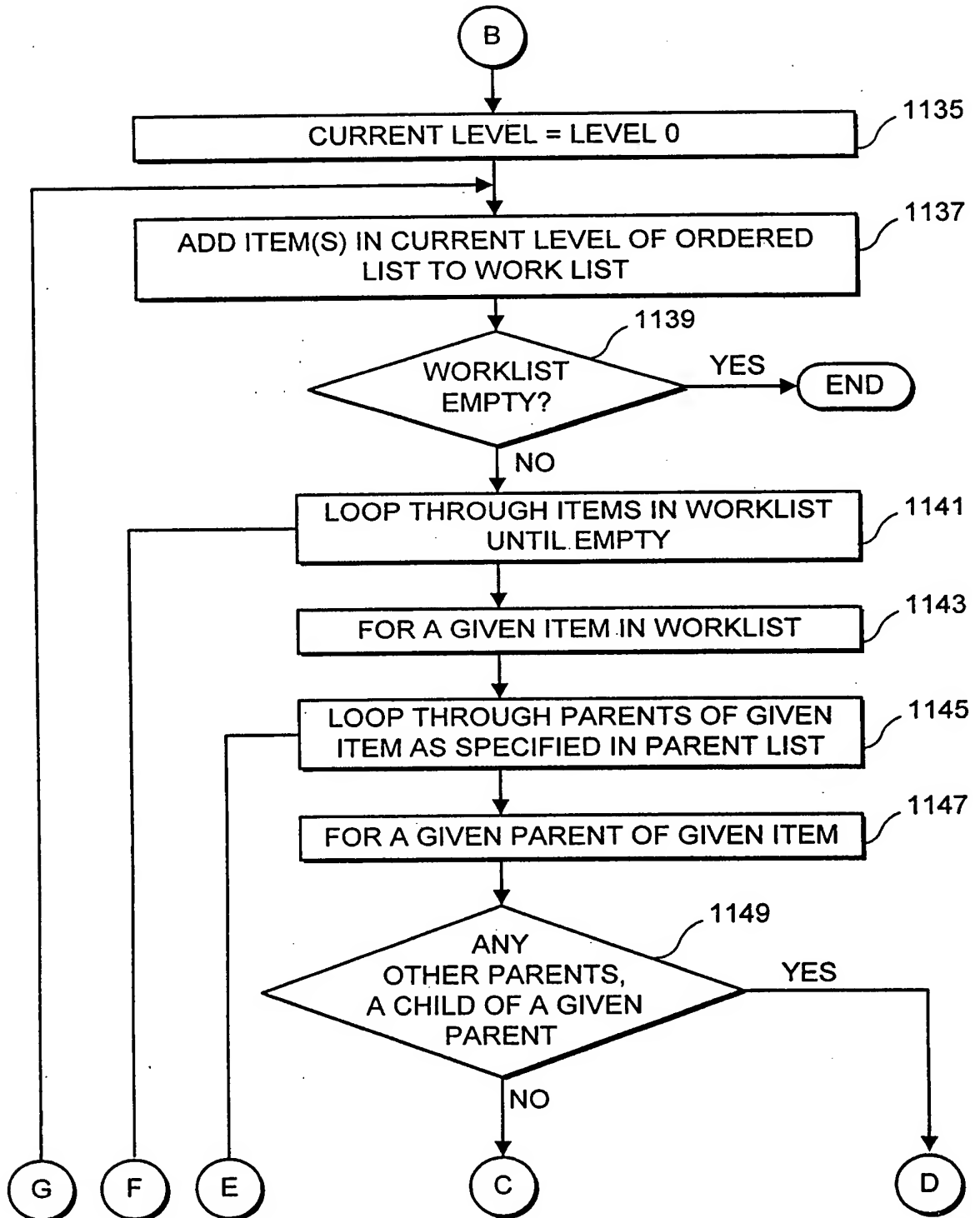


FIG. 11C(iii)

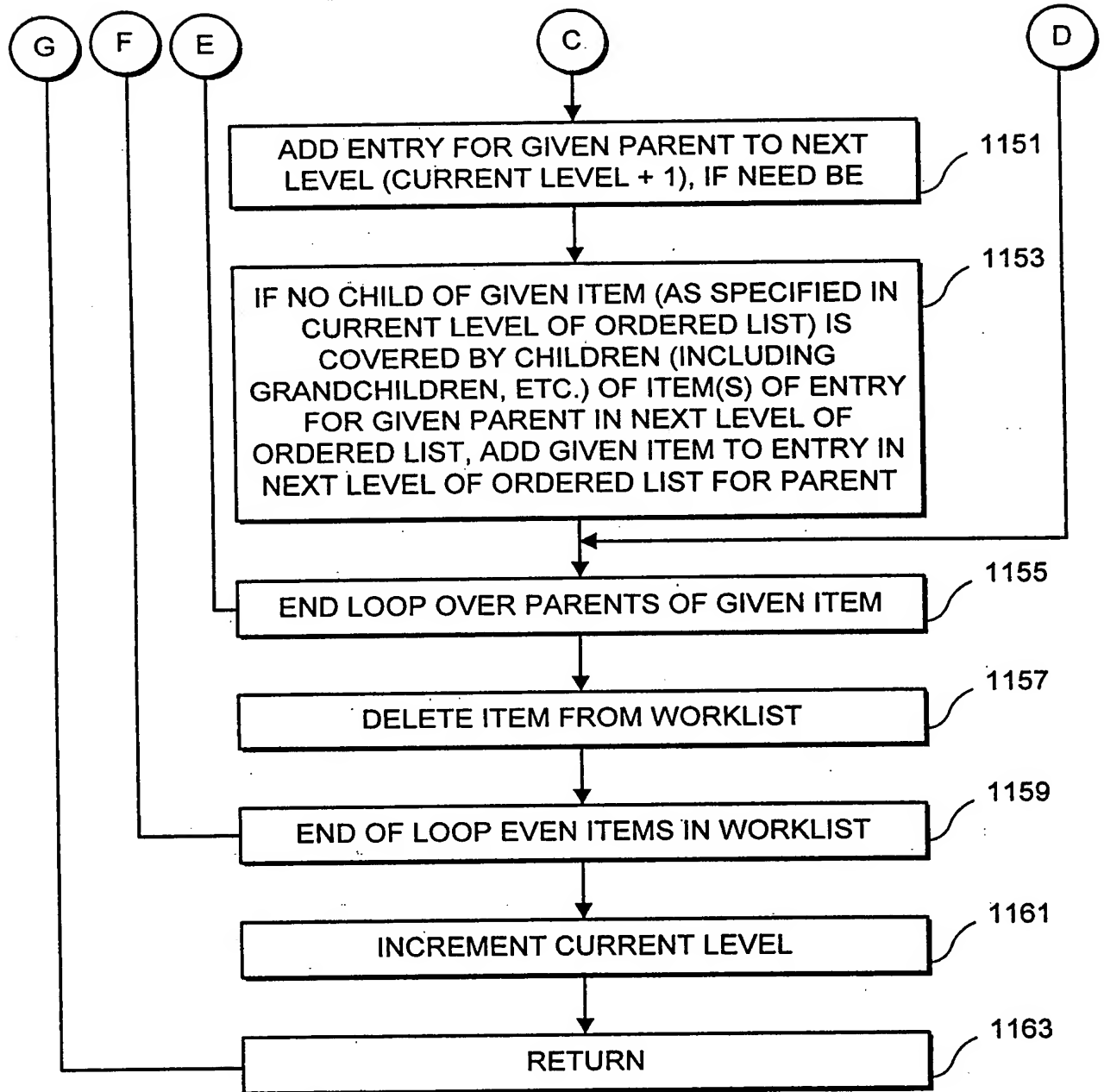


FIG. 11C(iv)

PARENT LIST

ITEM	PARENT(S)
A	C, H, D
B	C, I, D
F	E, H, D
G	E, I, D
C	D
H	D
E	D
I	D
D	—

FIG. 11C(v)

CHILD LIST

ITEM	CHILD(REN)
A	—
B	—
F	—
G	—
C	<A, B>
H	<F, G>
E	<A, F>
I	<B, G>
D	<A, B, F, G>, <H, I>, <C, E>

FIG. 11C(vi)

ORDERED LIST
LEVEL 0

ITEM	CHILD(REN)
A	—
B	—
F	—
G	—

FIG. 11C(vii)

ORDERED LIST
LEVEL 1

ITEM	CHILD(REN)
C	A, B
H	A, F
I	B, G
E	F, G

FIG. 11C(viii)

ORDERED LIST
LEVEL 2

ITEM	CHILD(REN)
D	C, E

FIG. 11C(ix)

AGGREGATION ENGINE
LOADING AND INDEXING MODULE
HIERARCHY TRANSFORMATION MODULE

FIG. 12

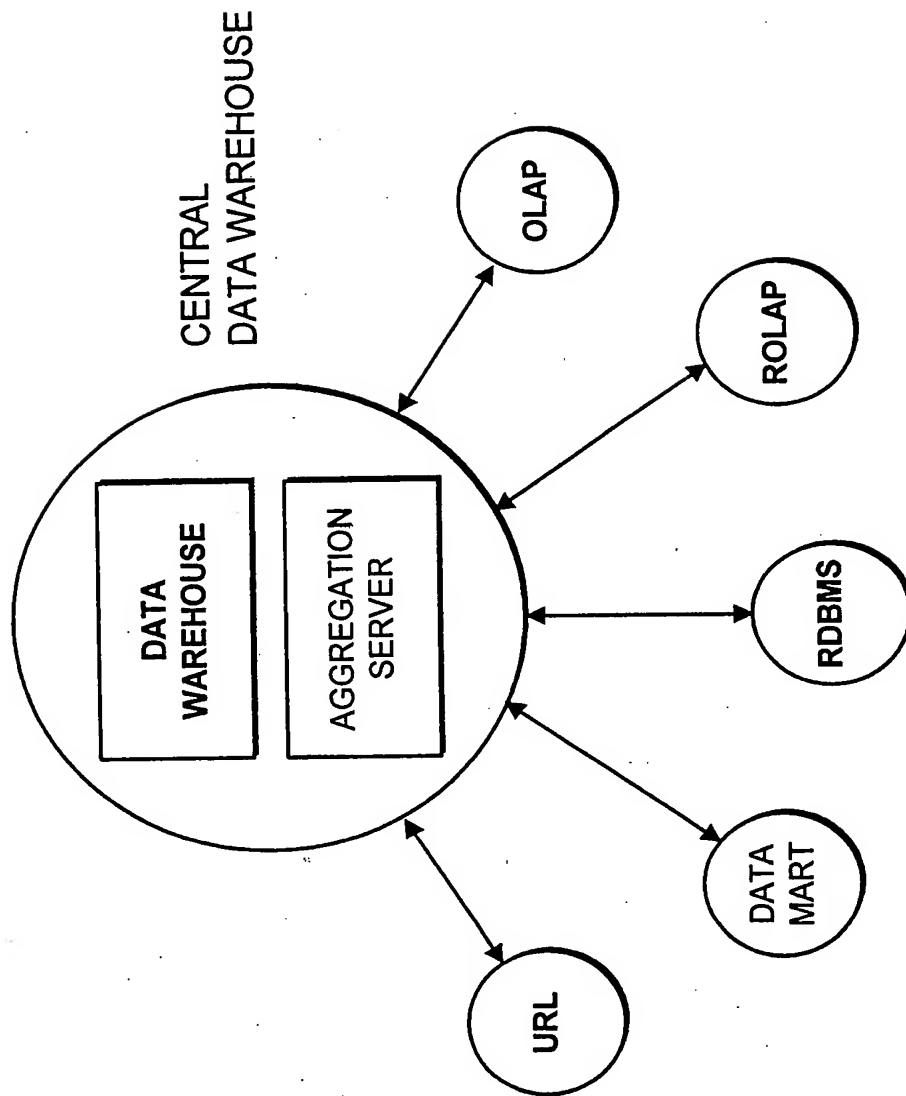


FIG. 13

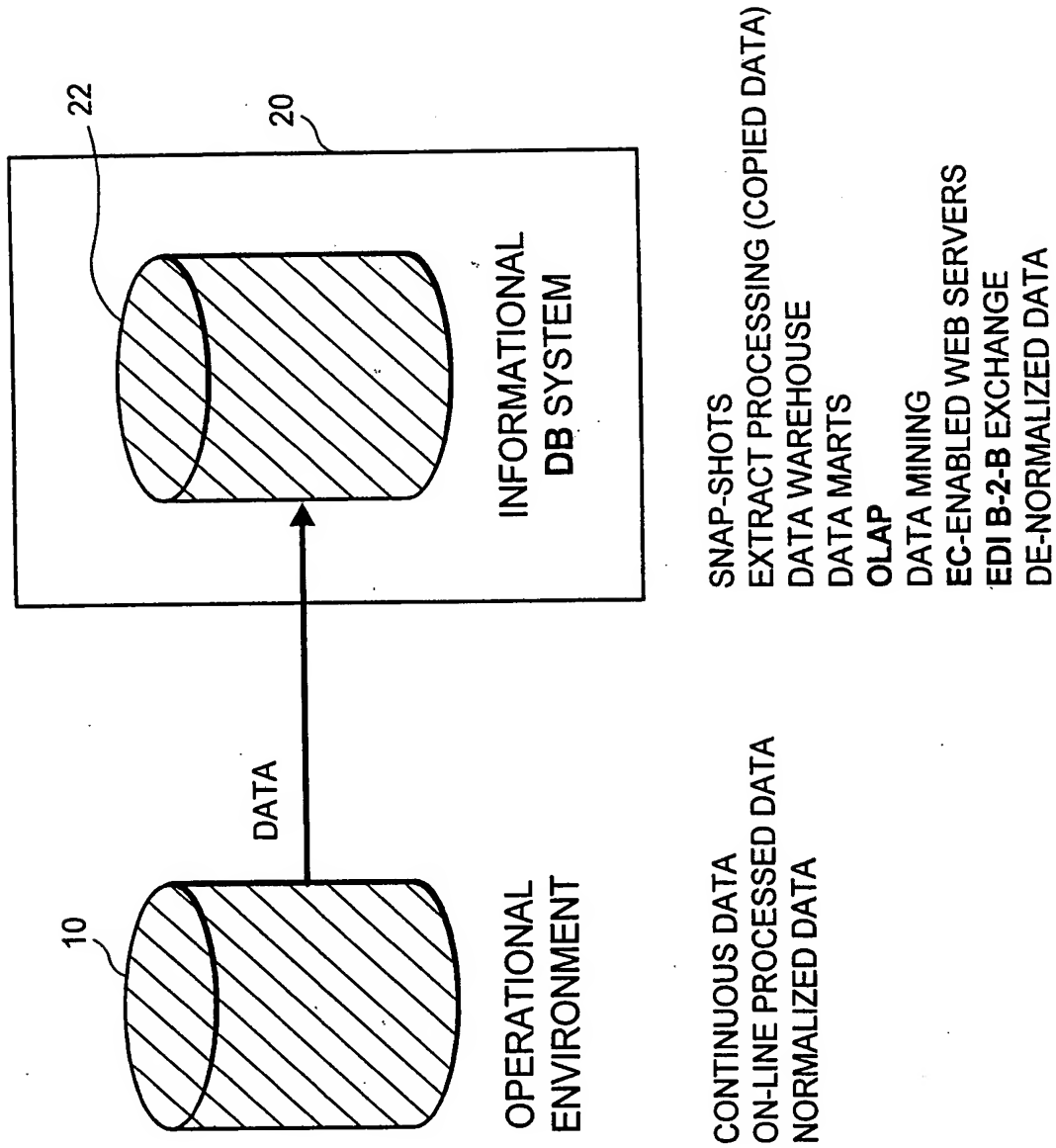


FIG. 14 (PRIOR ART)

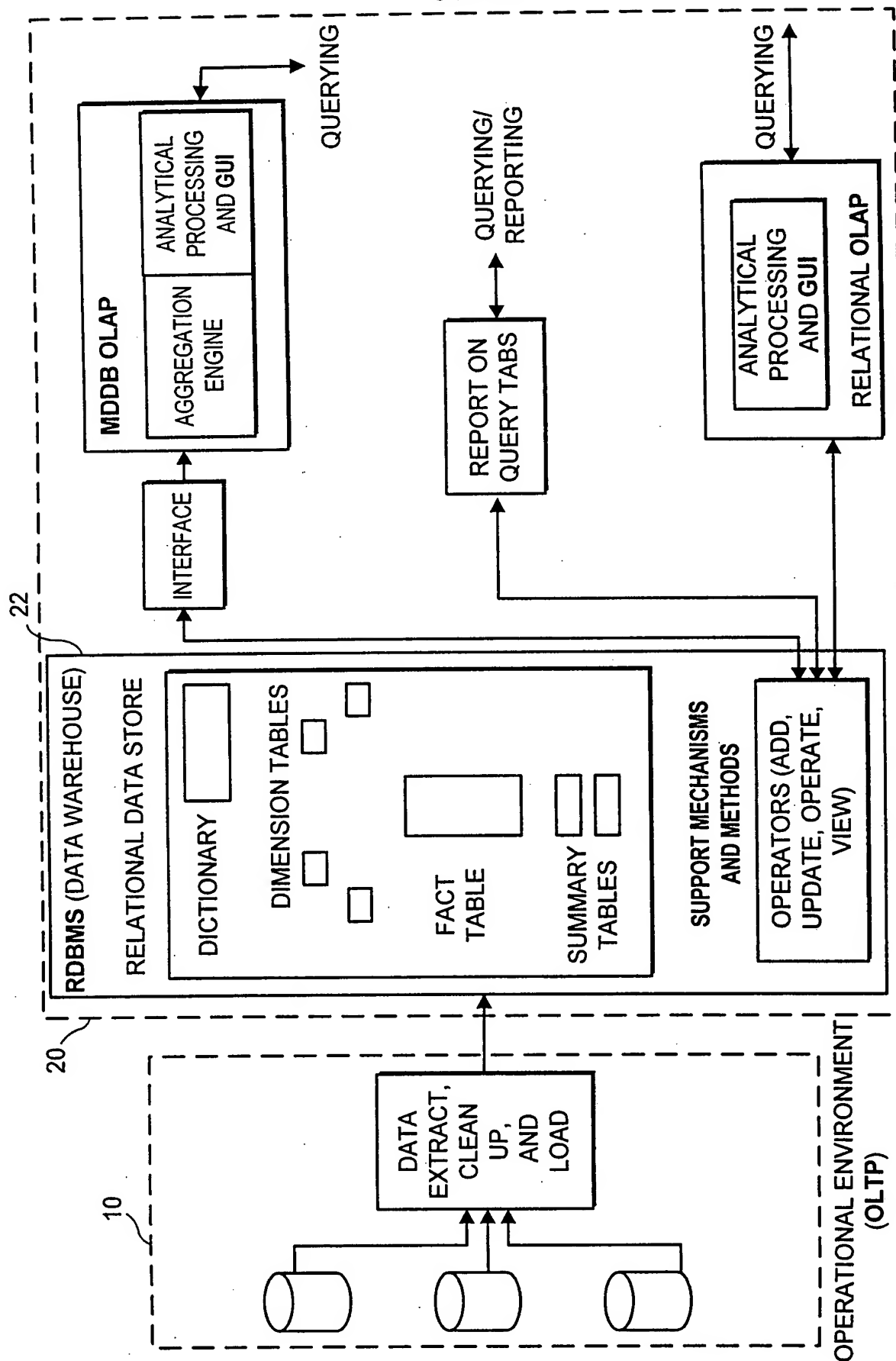


FIG. 15 (PRIOR ART)

CELLAR

WINE	YEAR	BOTTLES
CHARDONNAY	1996	4
FUME BLANK	1996	2
PINOT NOIR	1993	3
ZINFANDEL	1994	9

FIG. 16A

RESULT

RESTRICT: OPERATOR:
 SELECT WINE, YEAR,
 BOTTLES FROM CELLAR
 WHERE YEAR IS > 1995;

WINE	YEAR	BOTTLES
CHARDONNAY	1996	4
FUME BLANK	1996	2

FIG. 16B

RESULT

PROJECT: OPERATOR:
 SELECT WINE, BOTTLES
 FROM CELLAR;

WINE	BOTTLES
CHARDONNAY	4
FUME BLANK	2
PINOT NOIR	3
ZINFANDEL	9

FIG. 16C

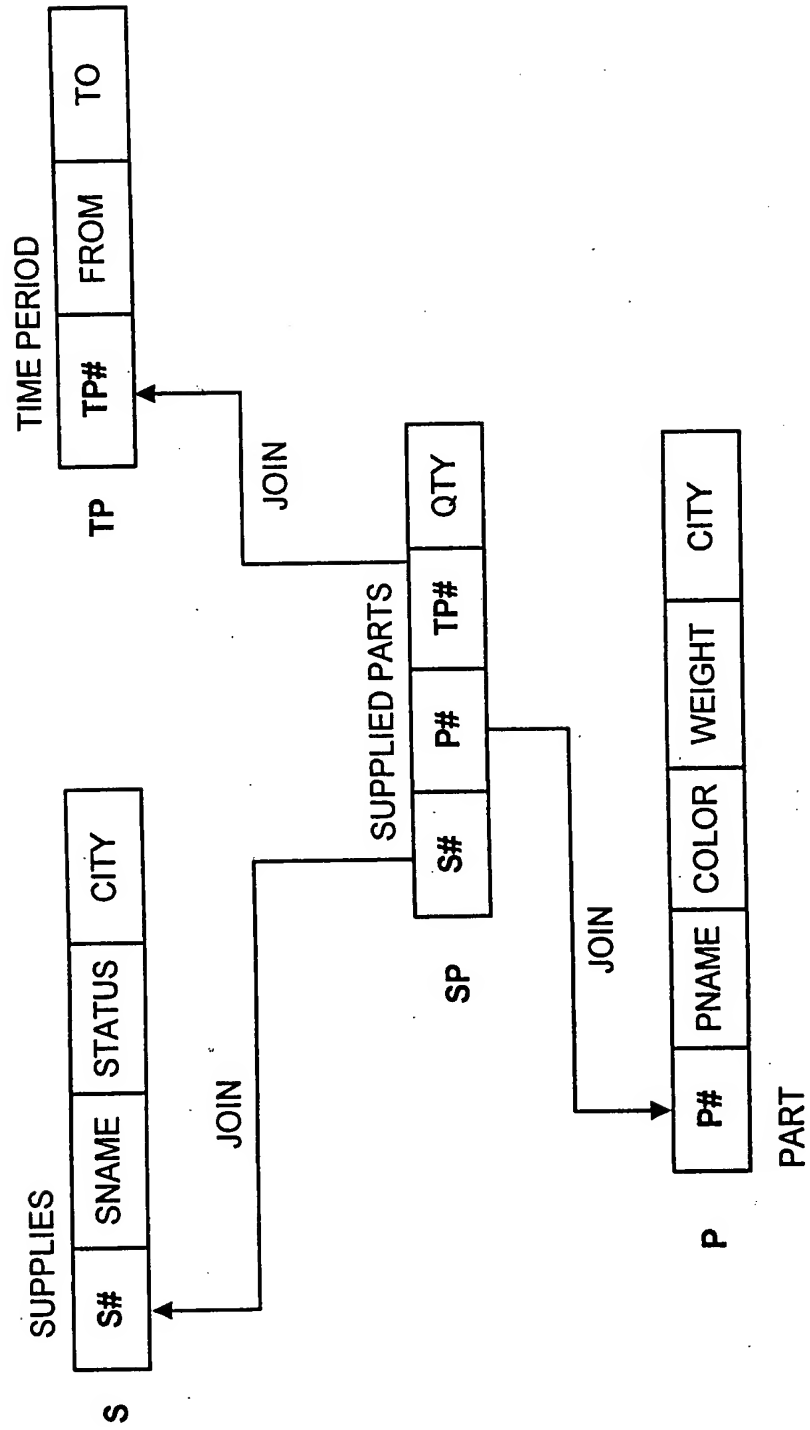


FIG. 17A

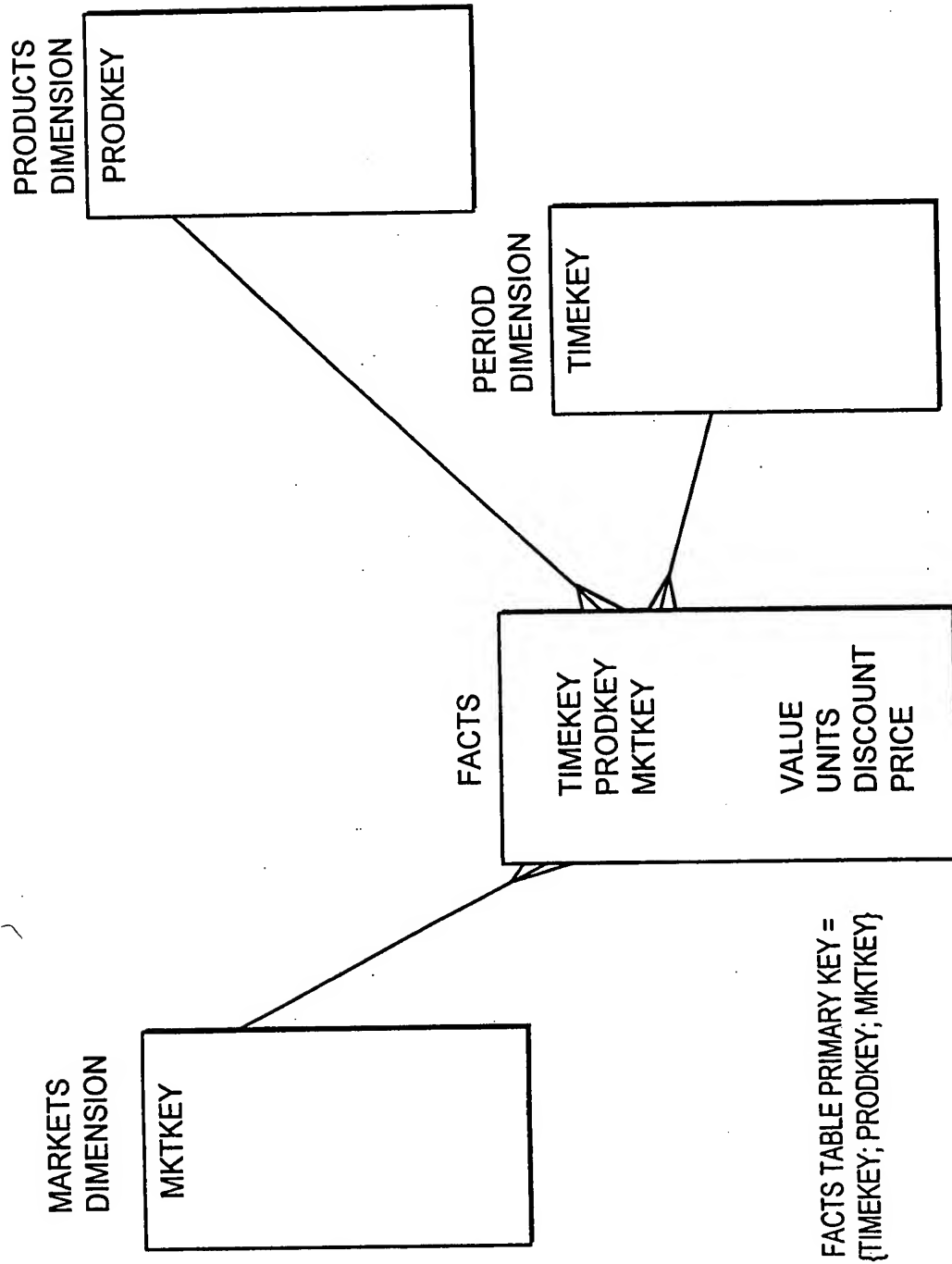


FIG. 18A

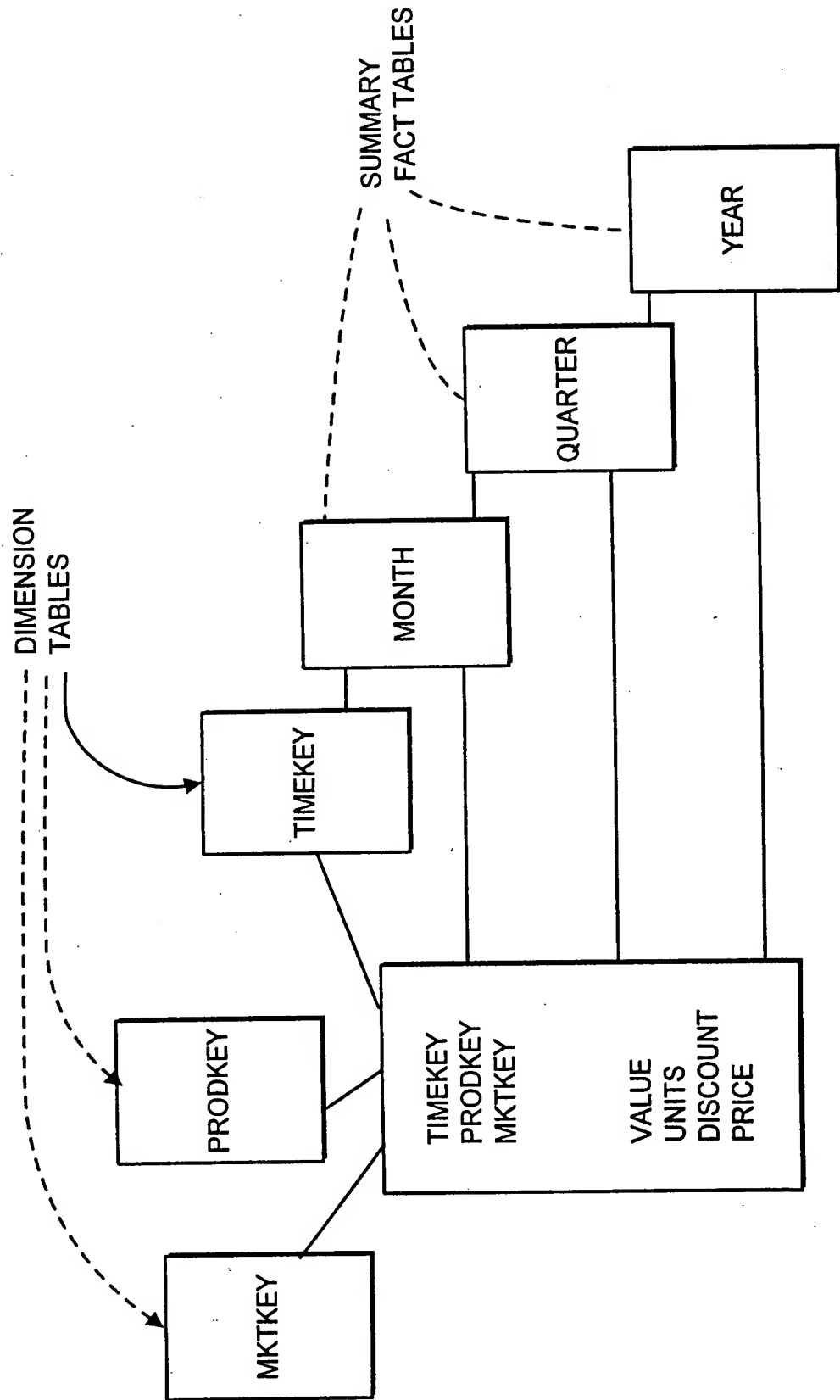


FIG. 18B

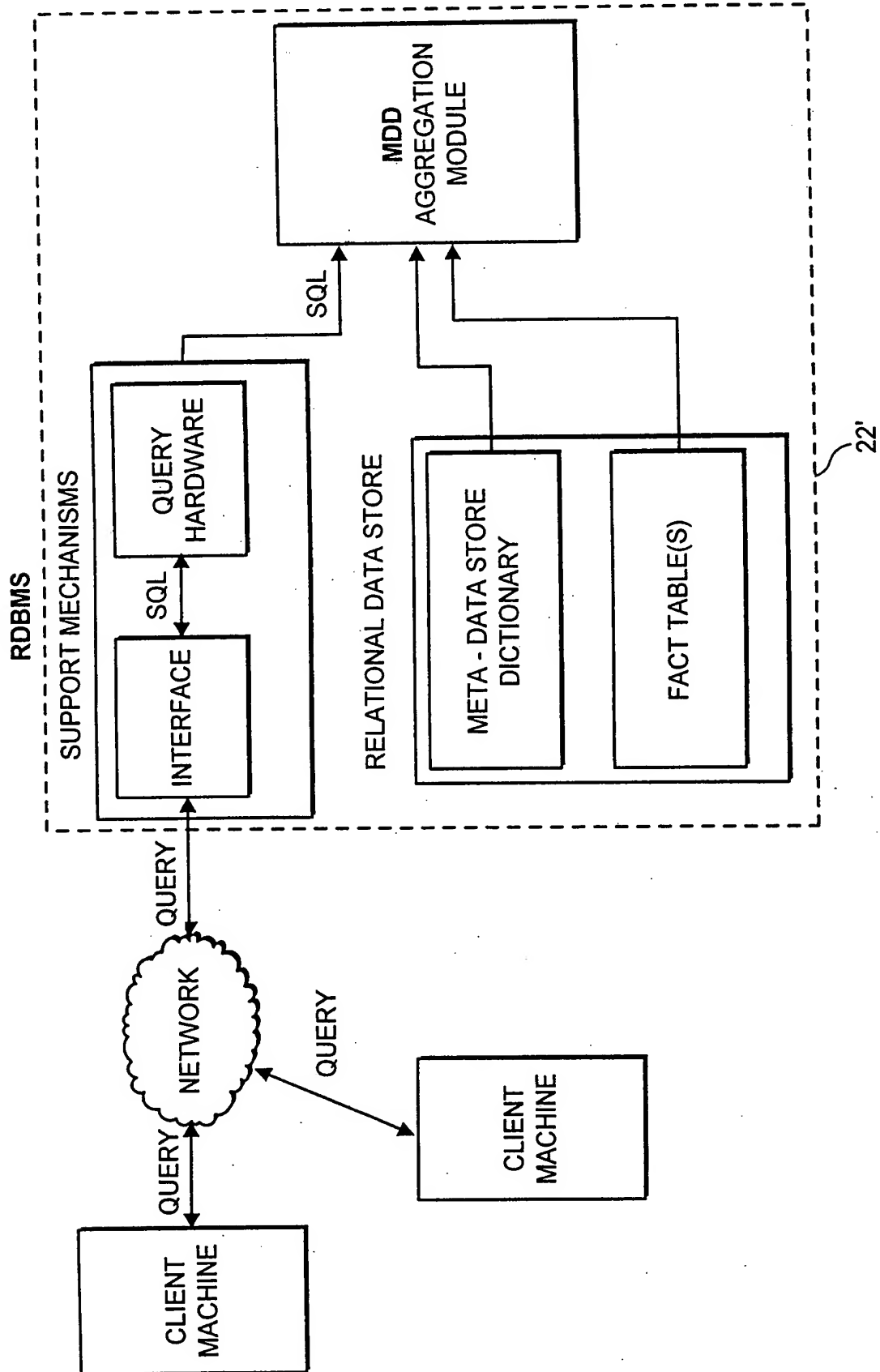


FIG. 19A

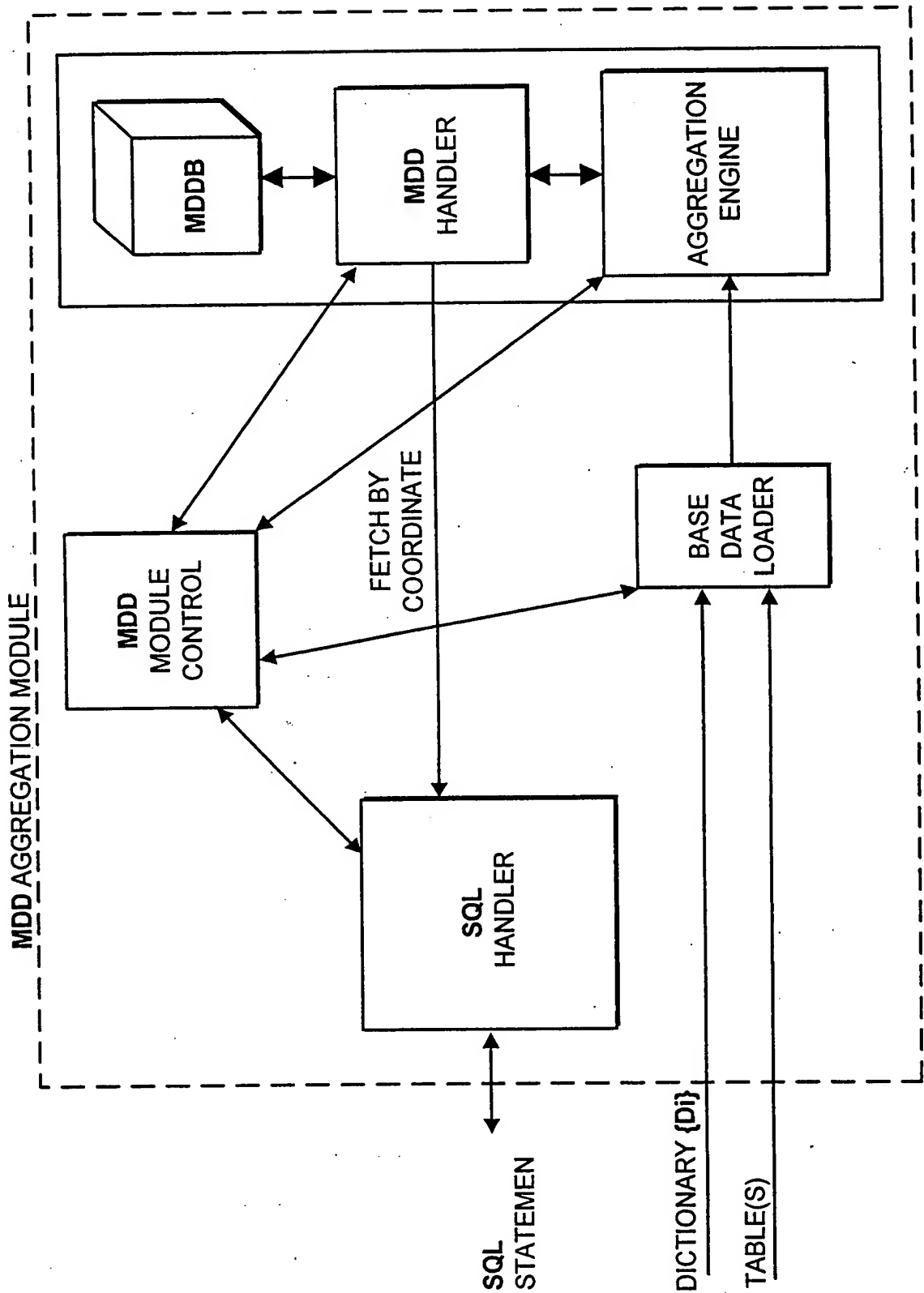


FIG. 19B

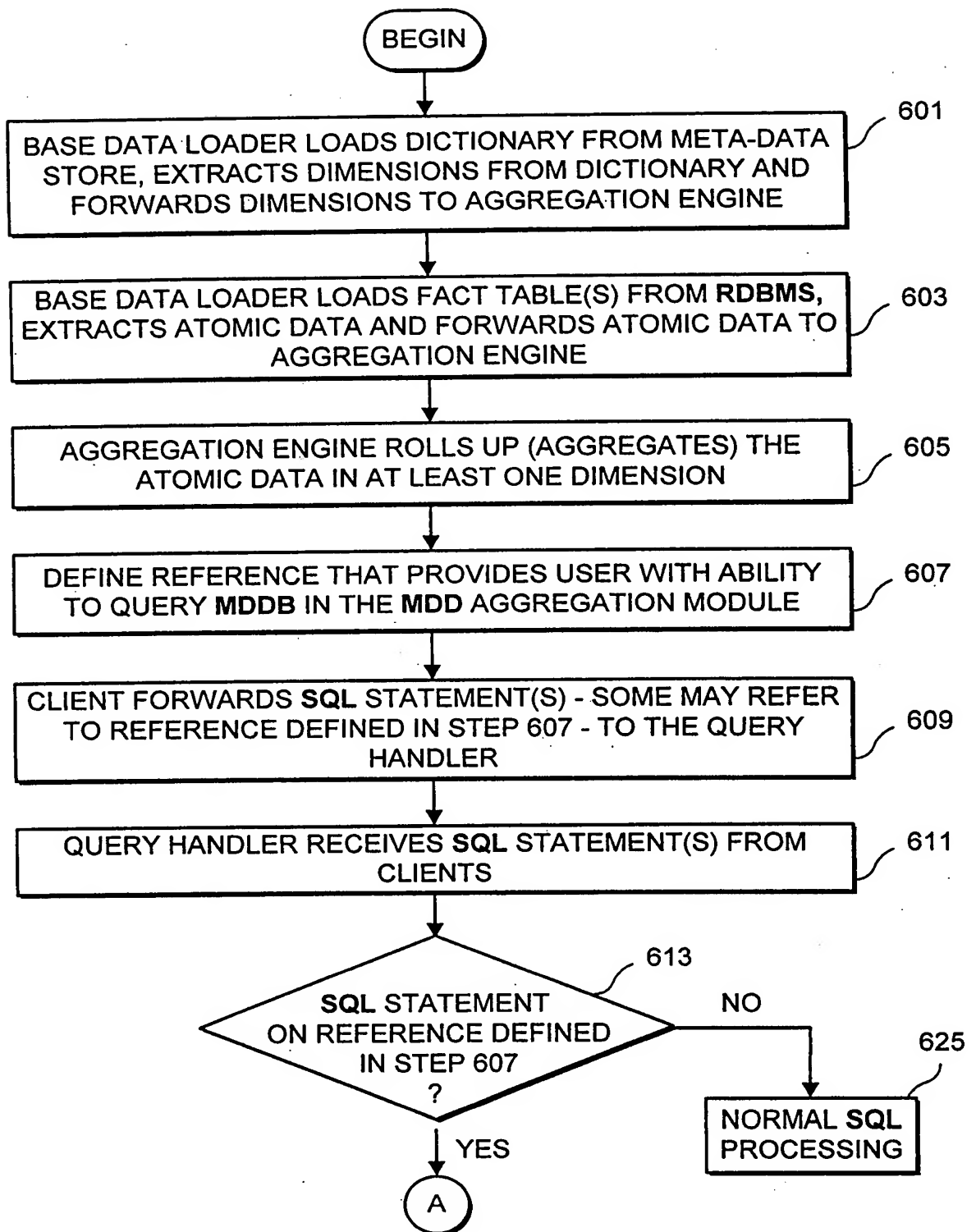


FIG. 19C(i)

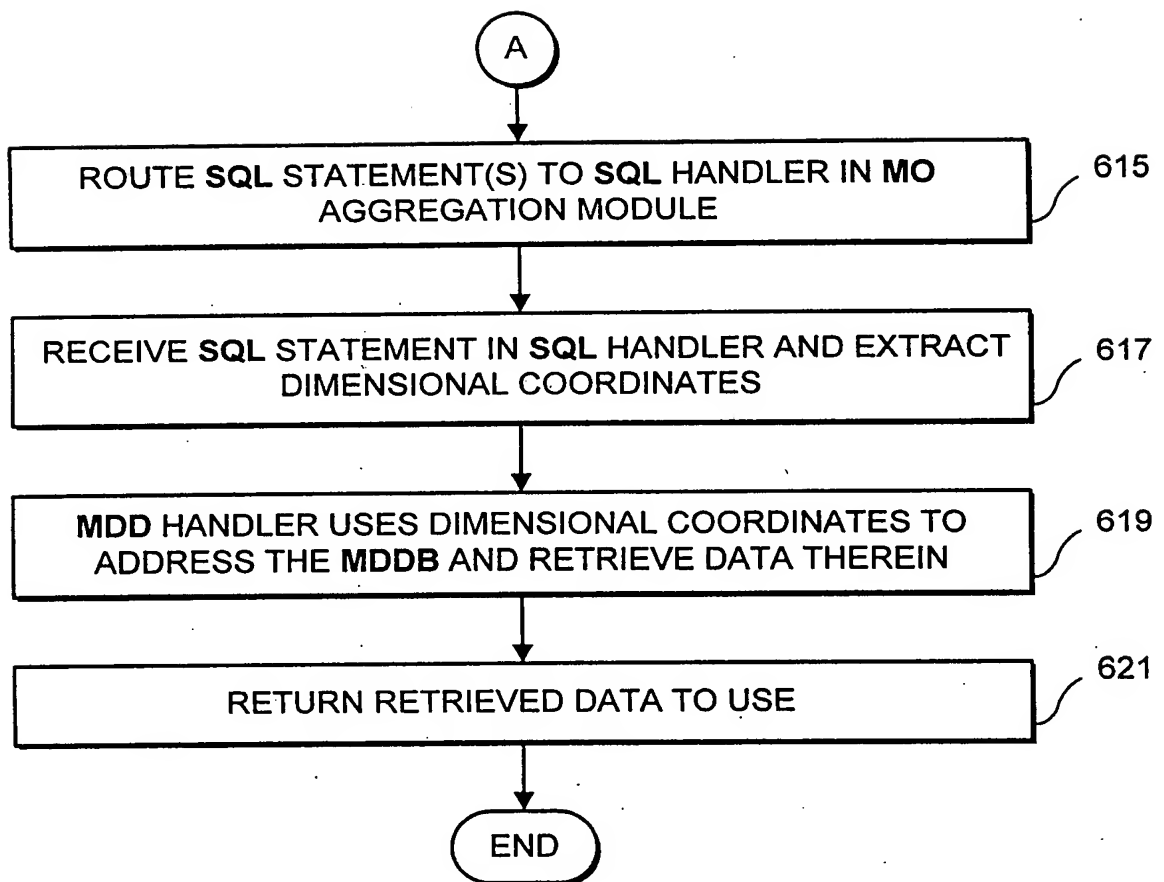


FIG. 19C(ii)

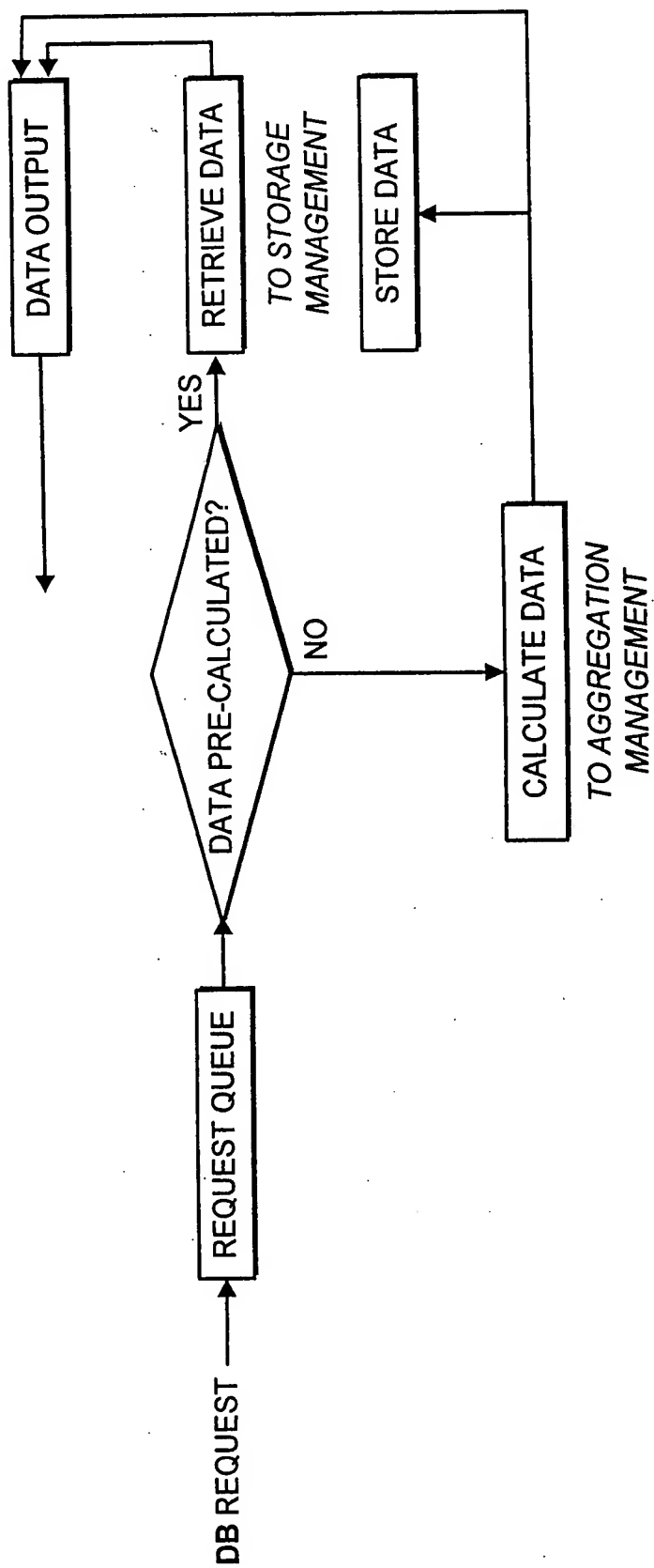


FIG. 19D

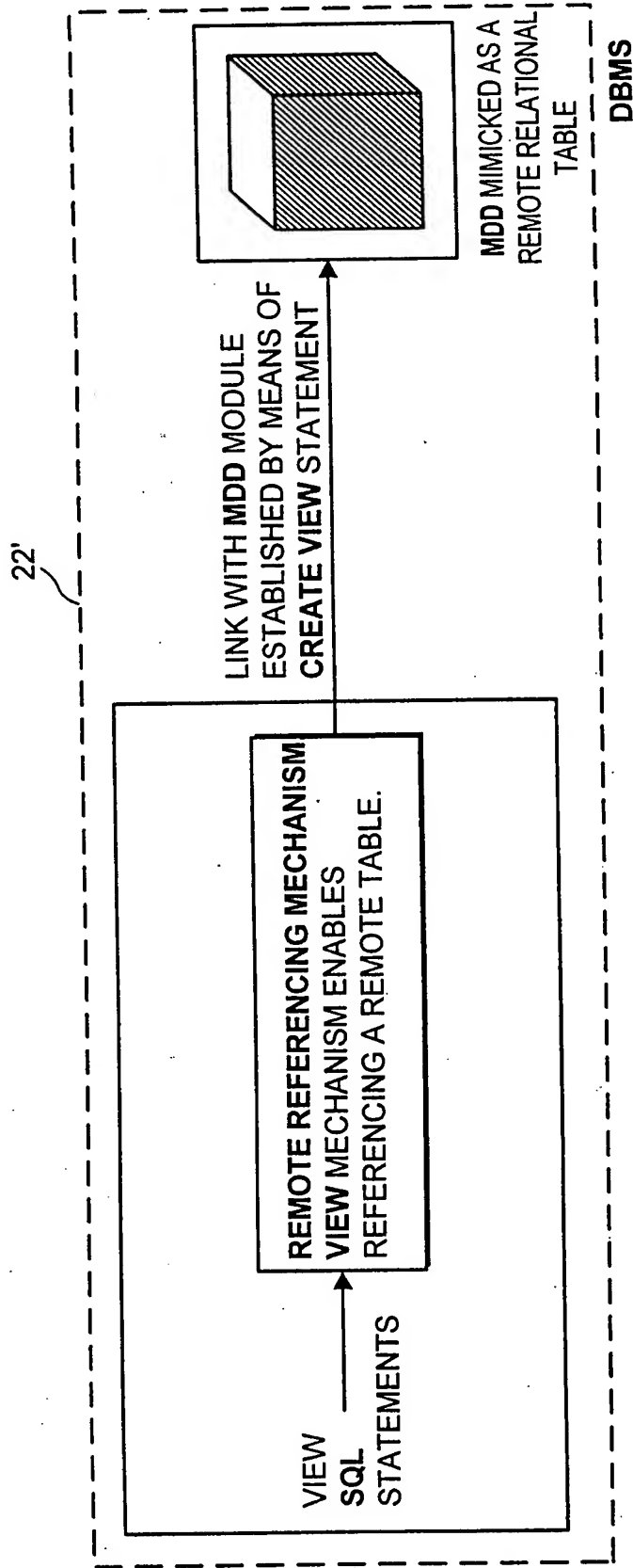


FIG. 19E

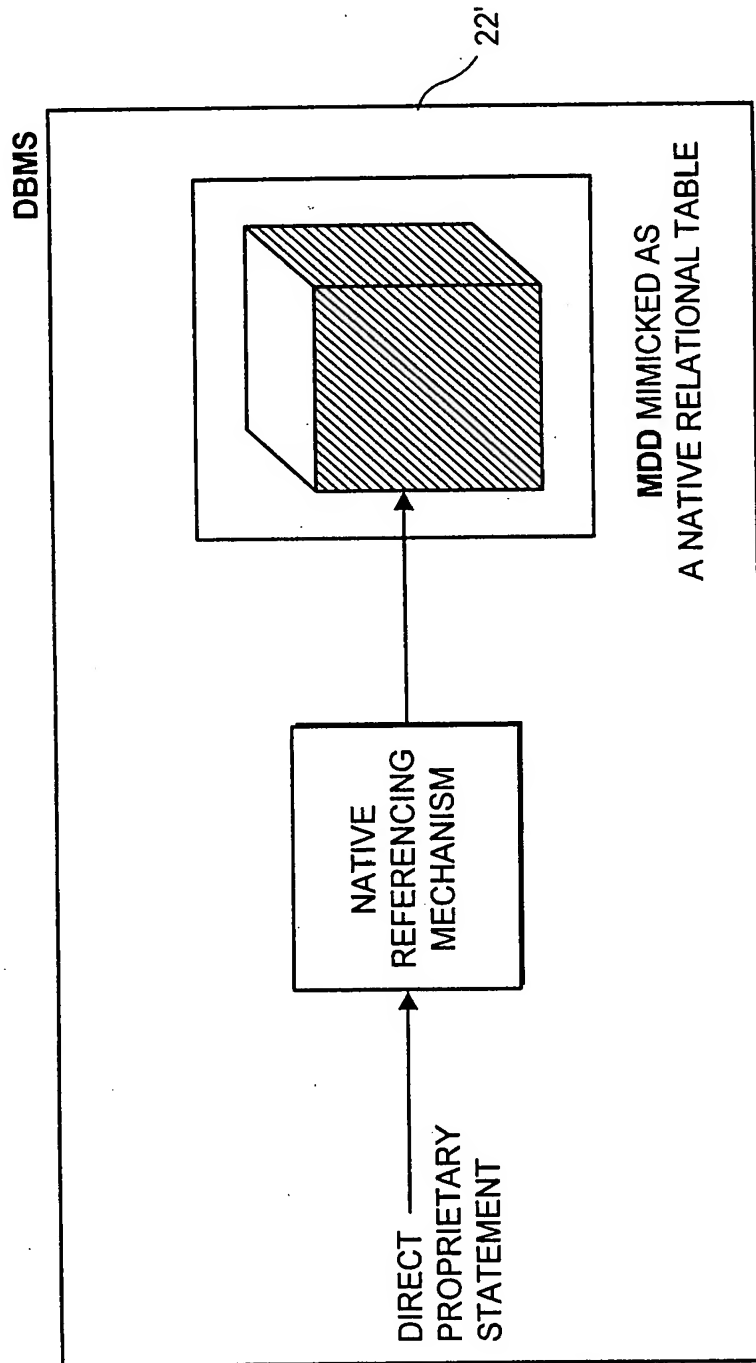


FIG. 19F

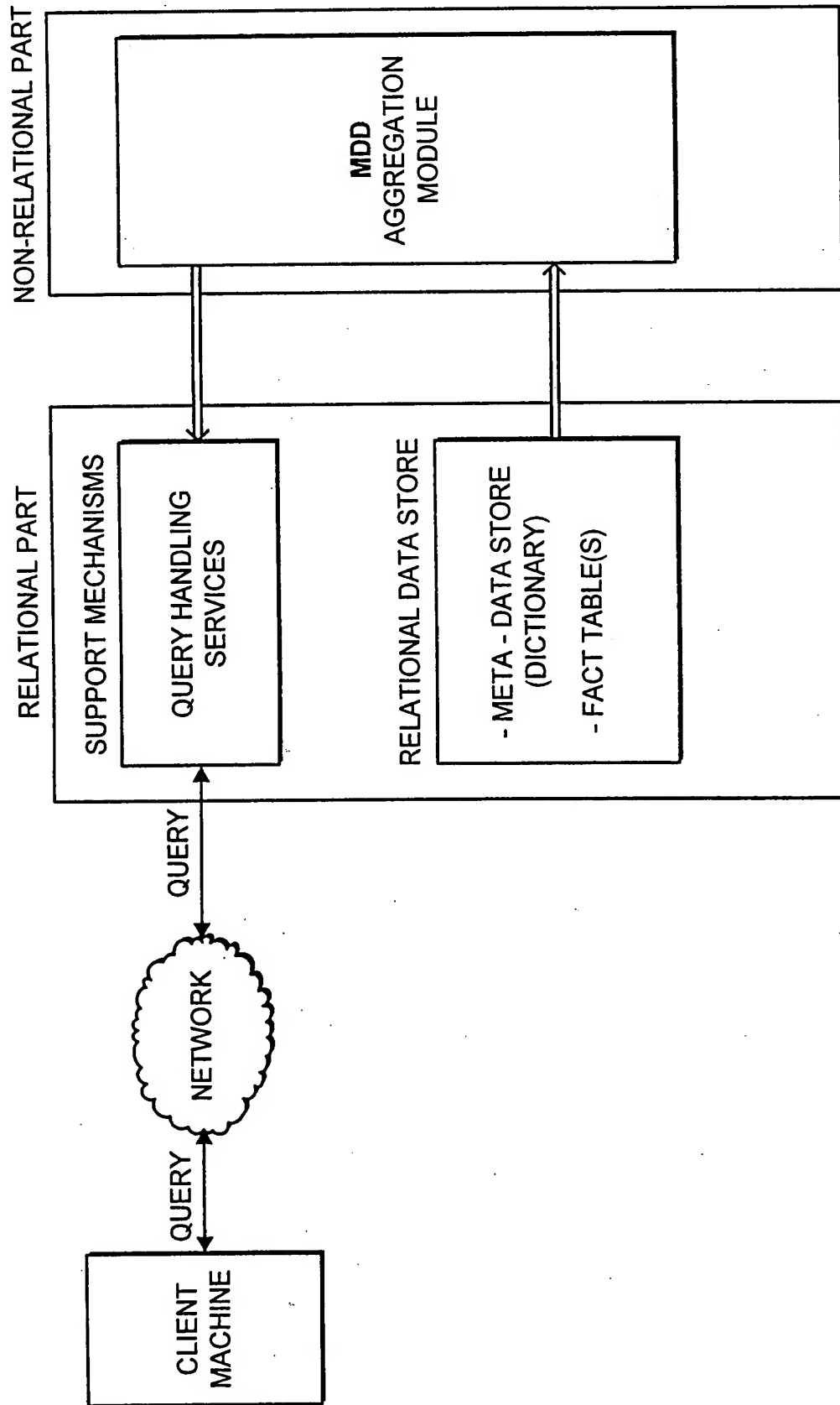


FIG. 19G

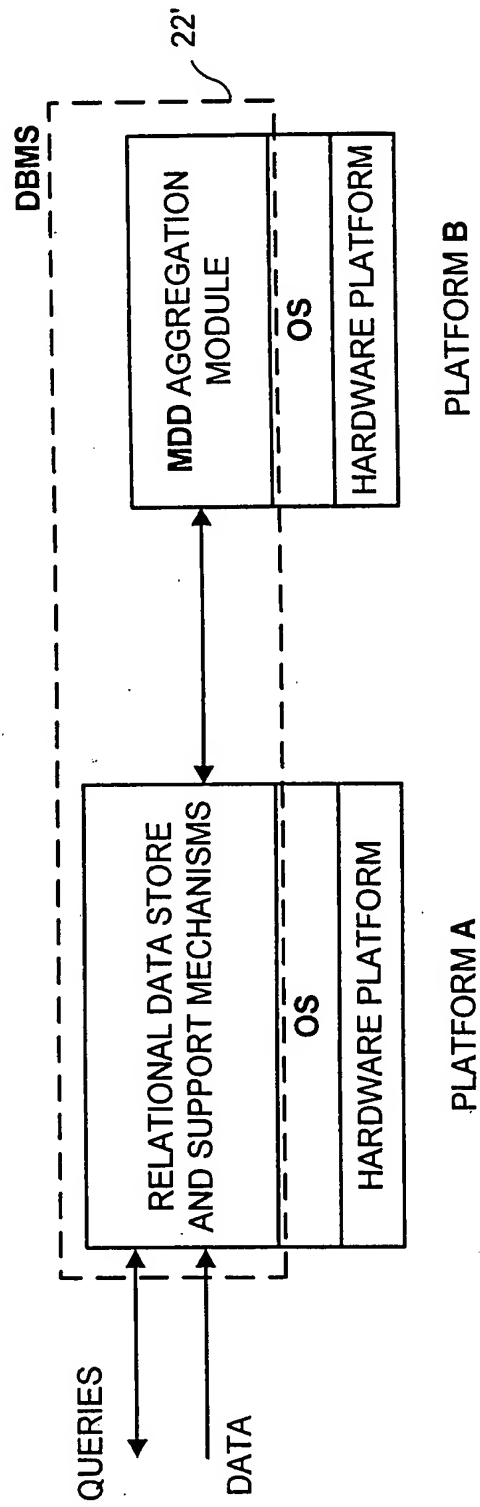


FIG. 20A

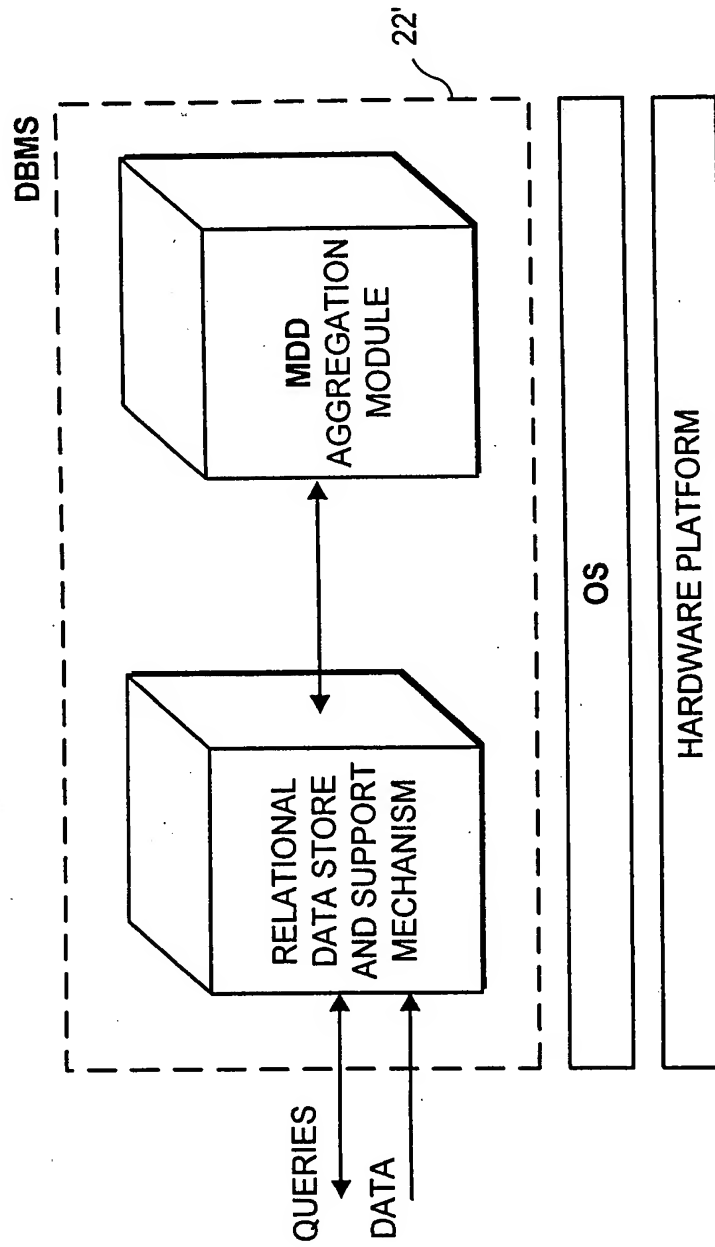


FIG. 20B

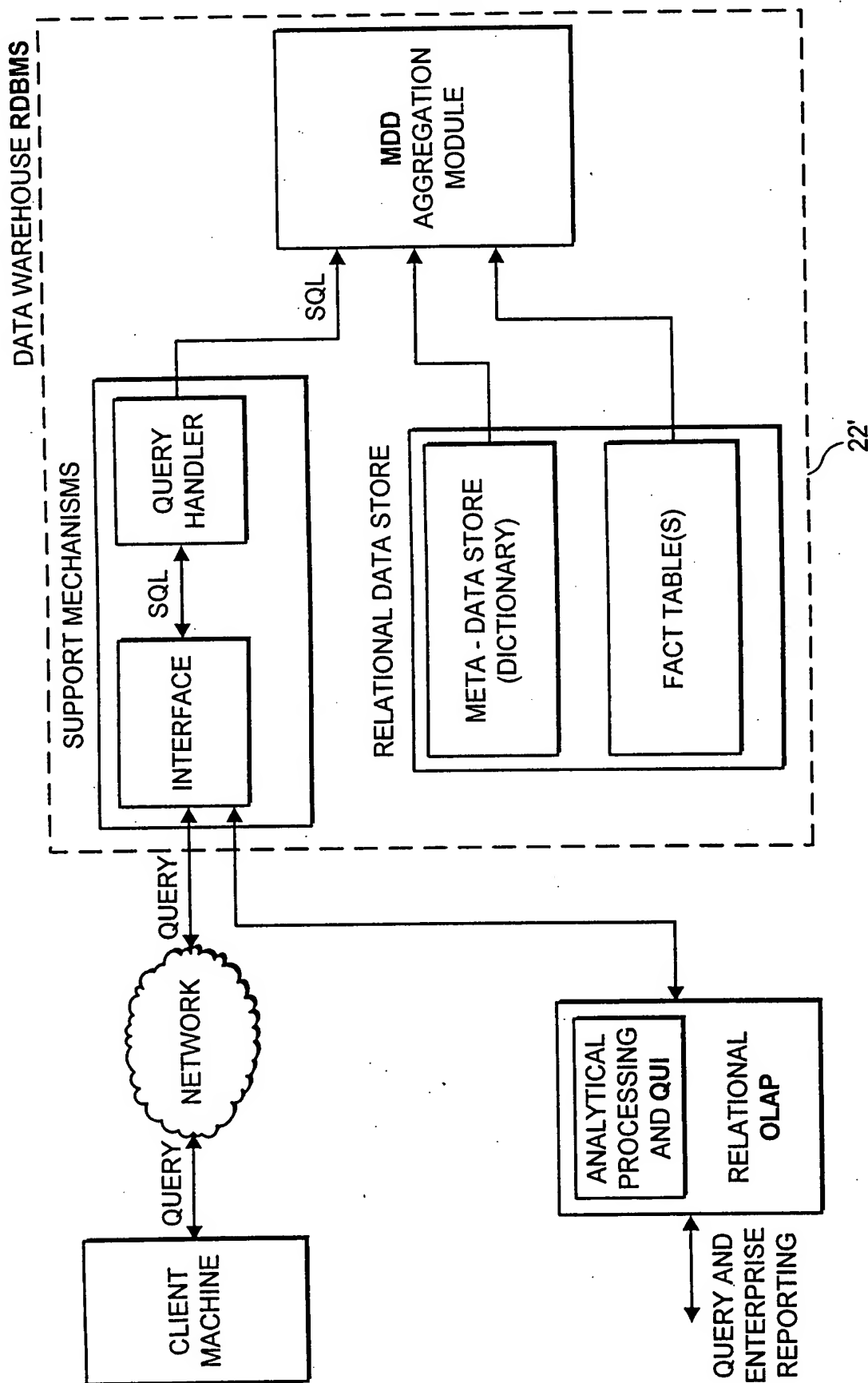


FIG. 21

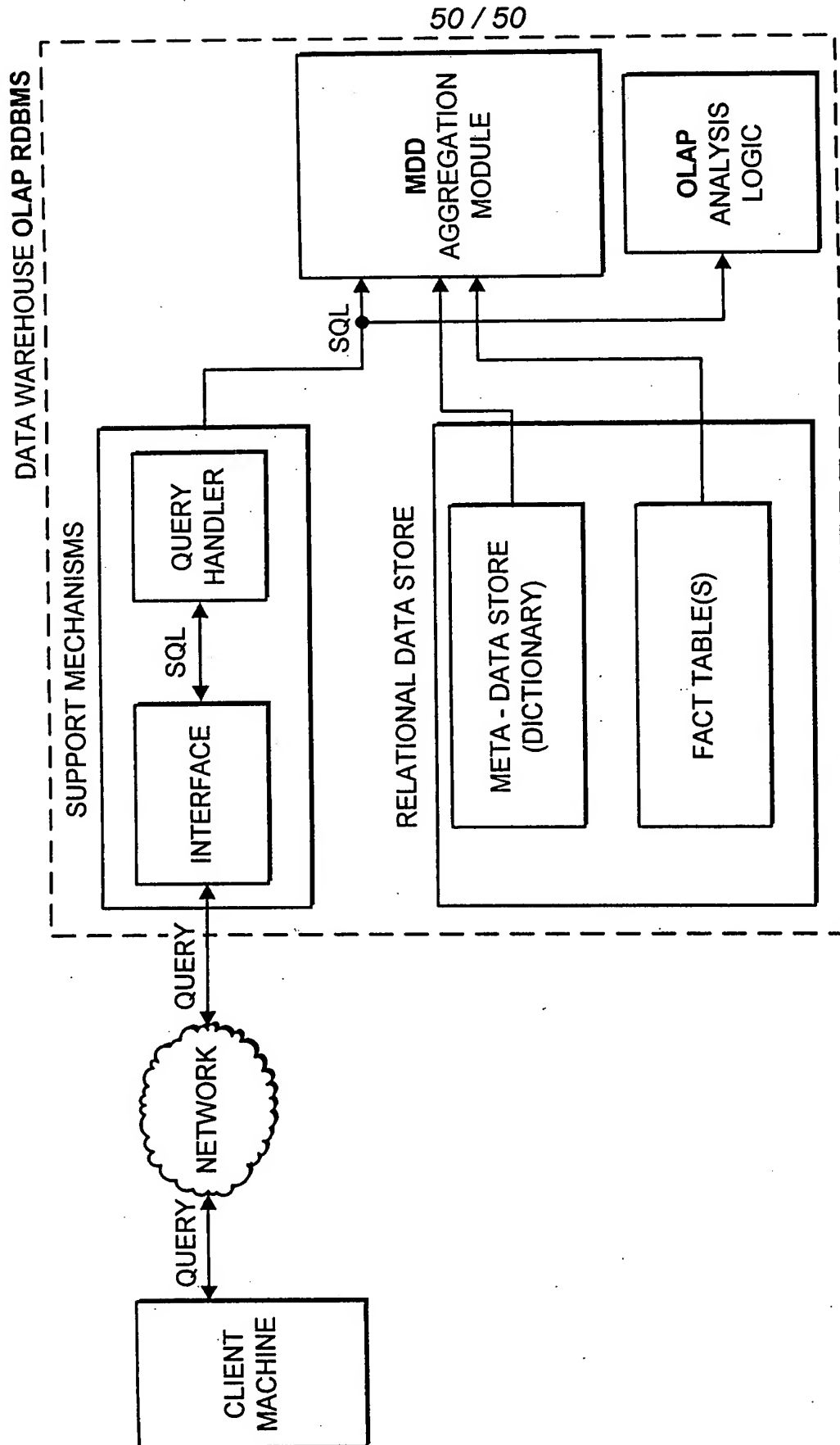


FIG. 22